Requisition # K-267150
Project: Council Maintenance Building and Sand Shed

INTENTION TO RESPOND
No Fax Cover Sheet Is Required

FAX BACK: 208 334-8824

Your assistance is requested.

To: Idaho Transportation Department
Purchasing Section
PO Box 7129
Boise, Idaho 83707-1129

BID CLOSES ON: 6/13/05 @ 5:00 P.M. **BID OPENS ON: 6/14/05 @ 9:00 A.M.**

Please check all that apply

_____ Company intends to prepare and submit a proposal to the requisition listed above.

_____ Company does not plan to respond.

_____ Company plans to attend Bid Opening.

_____ Other Message/Comments: _____ _____ _____ _____ ____

_____

_____

Company Name _____

Address _____

City_____ State_____ Zip_____

Contact Person _____
(Please Print)

Phone # _____ Fax # _____

IDAHO TRANSPORTATION DEPARTMENT
SIGNATURE PAGE

(THIS PAGE MUST BE SIGNED, WITH AN ORIGINAL SIGNATURE, AND RETURNED WITH YOUR BID DOCUMENTS.)

Idaho Transportation Department
Purchasing Section
3311 West State Street
Boise, Idaho 83703

Date: May 18, 2005

REQUISITION #: K-267150

ALL SEALED BIDS MUST BE RECEIVED BY 5:00 PM ON JUNE 13, 2005. SEALED BIDS WILL BE OPENED AT 9:00 AM ON JUNE 14, 2005 at the Idaho Transportation Department Purchasing Office, at 3311 West State Street in Boise. The scope of work on this project consists of furnishing all materials, equipment and labor for the **Design and Construction of a Rigid Steel Maintenance Building and a Sand Shed at Council, Adams County. This project is being bid with two (2) options: Fabric Sand Shed and Steel Sand Shed, ITD will select the option deemed to be in the best interest of the State, based on the total cost of ownership over a pre-determined period of time.**

A pre-bid walk through will be held, attendance is not mandatory. If a contractor wants to arrange a time to visit the site, contact Dick Powell at (208) 334-8348.

The State contractors License Board shall license bidders in the State of Idaho
Public Works Contractors License # _____

Contact Mark Little, Purchasing Agent at (208) 334-8822 for Bid Requirements and Clarification.

FOR BID PACKETS AND BID RESULTS VISIT: http://itd.idaho.gov/business/business.htm

RETURN BID IN A SEALED ENVELOPE CLEARLY MARKED AS SHOWN:
Requisition #: K-267150
Bid Open Date: 6/14/05 @ 9:00 am
Item Bidding: Council Mtce Blg and Sand Shed

Mailing Address
Idaho Transportation Department
Purchasing Section
P.O. Box 7129
Boise, Idaho 83707-1129

Company Name: _____
Mailing Address: _____
City: _____ State: _____ Zip: _____
Phone: _____ Fax: _____
Contractors Signature/Authorized Signature: _____

_____
Printed Signature

BY SIGNING, BIDDER ACKNOWLEDGES RESPONSIBILITY FOR ANY ADDENDA THAT HAS BEEN ISSUED FOR THIS SOLICITATION AND WILL COMPLY WITH ALL THE TERMS, CONDITIONS, AND SPECIFICATIONS OF THIS SOLICITATION.

INVITATION TO BID

ALL sealed Bids must be received by 5:00 P.M., on **June 13, 2005**. **ALL** Sealed Bids will be opened at **9:00 A.M.,** on **June 14, 2005** at the Idaho Transportation Department, Purchasing Section located at 3311 West State Street, Boise, Idaho. Bidders and other interested parties are invited to be present at the bid opening. This is to furnish all materials, equipment and labor for the **Design and Construction of a Rigid Steel Maintenance Building and a Sand Shed at Council,** per the specifications contained in requisition number **K-267150**.

PUBLIC WORKS LICENSE REQUIRED

No bid will be considered unless accompanied by an acceptable guaranty in an amount not less than five percent (5%) of the total amount of the bid. This guaranty must be in the form of a certified check or a cashier's check drawn on an Idaho bank, made payable to the Idaho Transportation Department, or a bidder's bond. Surety will be forfeited in the event of failure to sign the contract.

The Idaho Transportation Department reserves the right to reject all bids or to accept the bid deemed best for the State of Idaho.

Dated this 18th day of May

MARK LITTLE, PURCHASING AGENT
IDAHO TRANSPORTATION DEPARTMENT

Copies of Bid Packets, Bid Results and Plan Holders List, may be obtained by visiting our web site at: http://itd.idaho.gov/business/business.htm or by contacting your local Plan Room.

PUBLISH: 5/23-27/05

REVISED 1/05

BIDDERS RESPONSIBILITY PAGE

PLEASE NOTE: The following documents, IF APPLICABLE TO YOUR BID, must be returned to the Idaho Transportation Department Purchasing Section to allow your bid to be considered.

1.) **EFFECTIVE: January 1, 2005. Idaho Code, Section 72-1717 – Idaho Employer Alcohol and Drug-Free Workplace Act State Construction Contracts. Required on ALL State Construction or Improvement of Public Property or Publicly Owned Buildings.**

- **Affidavit of Alcohol and Drug Free Workplace Program**

2.) **"Signature Page"**

- Public Works License Number must be inserted
- Page must be signed with an original signature

3.) Bid Response

- Individual, Partnership, or Corporation
- One of three, depending upon company structure, MUST be completed, signed and notarized

4.) Bidder must complete Bid Schedule

5.) Bidder must complete Domicile Form

6.) Subcontractor form SC-1 – **as required per specifications**

7.) A 5% Bidders Bond or Cashier's Check

8.) **All Addenda** Must be Signed and returned with your Bid Documents
It is the Bidder's responsibility to verify if an addendum was issued.

9.) **ALL BIDS** must be submitted in a sealed enveloped with the Requisition Number, Bid Open Date, and Project Name clearly marked on the outside of the envelope.

10.) **NO BID ADJUSTMENTS WILL BE ACCEPTED:** Any changes made to a bid must be submitted as a separate bid and all rules remain in effect. ALL REQUIRED paperwork must be re-submitted.

11,) **PUBLIC WORKS LICENSE REQUIRED:** - Public Works Contractors License Board – Phone # (208) 334 8968. http://www2.idaho.gov/dbs

DOMICILE

PREFERENCE FOR IDAHO DOMICILED CONTRACTORS ON PUBLIC WORKS (Idaho Code 67-2348 - Effective July 1, 1982). To the extent permitted by federal laws and regulations, whenever the State of Idaho, or any department, division, bureau or agency thereof, or any city, county, school district, irrigation district, drainage district, sewer district, highway district, good road district, fire district, flood district, or other public body, shall let for bid any contract for bid any contract to a contractor for any public works, the contractor domiciled outside the boundaries of Idaho shall be required, in order to be successful, to submit a bid the same percent less than the lowest bid submitted by a responsible contractor domiciled in Idaho as would be required for such an Idaho domiciled contractor to succeed over the bidding contractor domiciled outside Idaho on a like contract being let in his domiciliary state.

If the bidder is unsure of where their business is domiciled, the following "rule of thumb" may help!

1) Corporation: Domiciled where chartered.

2) Sole Proprietor: Domiciled where permanent headquarters of business located.

3) Partnership: Domiciled where permanent headquarters of business located.

COMPANY NAME: _____

STATE OF DOMICILE: _____

NOTE: THIS PAGE MUST BE RETURNED WITH YOUR BID DOCUMENTS!

REVISED 1/01

SPECIAL PROVISION
IDAHO BUILDING

Furnish all materials, equipment and labor for the **Design and Construction of a Rigid Steel Maintenance Building and a Sand Shed at Council,** as per the specifications contained in requisition number **K-267150**.

The following Special Provisions supplement or modify the 2004 State Standard Specifications for Highway Construction and SP-SA Special Provisions – State Aid.

The plans shall be supplemented by the Contractor for such working drawings as are necessary to adequately control the work.

Materials incorporated into this project shall be new and free from defects and of the best commercial quality for the purpose specified.

The Idaho Transportation Department's Standard Specifications for Highway Construction manual is available to the Contractor for $30.00 plus tax. Contract the Idaho Transportation Department at 334-8430 to purchase. Note: The Standard Specifications of Highway Construction can also be viewed and downloaded: http://itd.idaho.gov/

LIQUIDATED DAMAGES

The amount of Liquidated Damages for failure to complete the work on time of this project will be **$100.00 per day**.

Contractor shall submit all required submittals within 30-days of contract signing. Authority to proceed will be given after building and foundation submittals are approved and returned to the Contractor, as well as, construction and material delivery schedules are established

CONTRACTOR'S NOTES

The Contractor shall indemnify, save harmless and defend regardless of outcome the State from the expenses of and against all suits, actions, claims, or costs, expenses and attorney fees that may be incurred because of any injuries or damages received or sustained by any person, persons, or property on account of the operations of the Contractor or his subcontractors; or on account of or in consequence of any neglect in safeguarding the work; or through use of unacceptable materials in constructing the work; or because of any act or omission, neglect, or misconduct of the Contractor or his subcontractors; or because of any claims or amounts recovered from any infringements of patent, trademark, or copyright; or from any claims or amounts arising or recovered under the Workmen's Compensation Act or any other law, ordinance, order or decree.

The Contractor shall carry such public liability and property damage insurance that will protect him and the State from claims for damages for bodily injury, including accidental death, as well as for claims for property damages, which may arise from operations under the contract whether such operations be by himself or by any subcontractor or by anyone directly or indirectly employed by either of them and the amounts of such insurance shall not be less than:

SPECIAL PROVISION
IDAHO BUILDING

CONTRACTOR'S NOTES

1) Comprehensive General Liability Insurance with a minimum combined single limits $1,000,000.00 each occurrence. The policy shall include coverage for bodily injury, broad form property damage (including completed operations), personal injury (including employee acts), blanket contractual, contractor's protective, products and completed operations. Further, the policy shall include coverage for the hazards commonly referred to as XCU (explosion, collapse and underground). This protection may be provided by the subcontractor, naming the Prime Contractor and State as insured. This supplemental insurance must be submitted prior to the subcontractor starting XCU operations.

   If the policies required by Comprehensive General Liability and Comprehensive Automobile Liability Insurance, has an aggregate limit, it shall not be less than a $1,000,000.00 annual limit.

2. Comprehensive Automobile Liability Insurance with a combined single limit for bodily injury and property damage of not less than $1,000,000.00 each occurrence with respect to contractor's owned hired, or non-owned vehicles, assigned to or used in performance of work. The policies required by Comprehensive Liability and Comprehensive Automobile Liability Insurance paragraphs above shall be endorsed to include the Department, its agents, officials, employees and the State of Idaho as additional insured's and shall stipulate that the insurance afforded the Contractor shall be primary insurance and that any insurance carried by the Department, its agents, officials, employees and the State of Idaho shall be excess and not contributory insurance to that provided by the Contractor. The insurance shall contain a severability of interests' provision.

   The Contractor shall not commence work under the contract until he obtains all insurance required under this provision and furnishes a certificate or other form showing proof of current coverage to the State and to the railroad or railway company, when involved. All insurance policies and certificates must be signed copies. After work commences, the Contractor will keep in force all required insurance until written acceptance of the project.

In addition to the above-required Liability Insurance coverage, the Contractor shall carry Worker's Compensation Insurance as required by Idaho Code covering the Contractors' and Subcontractors' work force. Certifications of Workmen's Compensation Insurance shall correspond to the requirements for Liability Insurance certification included herein.

The certifications must state that no cancellations or changes of any of the required policies shall be effective without 30 days prior written notice to the State and railroad or railway company involved.

Upon written acceptance of the project by the State, the Contractor will be relieved of responsibility to the public for subsequent injury or damage on the project.

SPECIAL PROVISION
IDAHO BUILDING

GENERAL

The Contractor shall supplement the plans for such working drawings as are necessary to adequately control the work. Materials incorporated into this project shall be new and free from defects and of the best commercial quality for the purpose specified.

The Idaho Transportation Department's Standard Specifications for Highway Construction manual is available to the Contractor for $30.00 plus tax. Contact the Idaho Transportation Department at 334-8430 to purchase. Note: The Standard Specifications of Highway Construction can also be viewed and downloaded: http://itd.idaho.gov/. Where general and supplementary conditions and division 1-specification sections are referred to; current industry standards shall be followed. Owner shall be construed to mean the State of Idaho through the Idaho Transportation Department (ITD). Where approval of Architect or Engineer is required, it shall be construed to mean the Resident Engineer.

The Contractor, before commencing work, shall purchase and maintain property insurance against fire with extended coverage, including loss or damage by vandalism and malicious mischief on this work to the full insurable value thereof, with insurance approved by the State and any loss made payable to the State, as his interest may be at the time of said loss. He shall furnish a copy of the insurance policy to the Engineer. No cancellation or change in this policy shall be effective without 30 days prior written notice to the Engineer.

INFORMATION GIVEN PRIOR TO AWARD

Oral explanations, instructions and interpretations given to bidders prior to award of contract will not be binding. It is the Department's intent to provide all bidders equal opportunity to access and acquire all available pertinent information necessary to formulate a responsive bid. Any information, specifications, plans, data or interpretations which the Department discovers is lacking and may be important to all bidders, will be furnished to all bidders in the form of an addendum, the receipt of which shall be acknowledged.

GUARANTEE

Excepting where certain portions of the work call for a longer period, all work shall be guaranteed for a minimum period of one year after the date of final acceptance; during the guarantee period, any repairs or replacements required because of defective workmanship or material shall be at the Contractor's expense.

WARRANTIES, GUARANTEES AND INSTRUCTION SHEETS

Three (3) copies of the manufacturer's warranties, guarantees, instruction sheets, and parts lists for all Contractors' furnished materials shall be turned over to the State upon completion of the project.

TEMPORARY UTILITIES

Contractor shall provide temporary power pole and power. The contractor shall visit the site and determine what measure, if any, he will have to take to provide for water for construction work, which may occur before the time that permanent services will be available.

SPECIAL PROVISION
IDAHO BUILDING

TEMPORARY UTILITIES

The contractor shall make arrangements for and furnish at their own expense, all water, sanitary facilities and other utilities necessary for construction purposes. All utilities shall be at contractor's expense until final acceptance.

The Contractor shall provide and maintain weather protection and heating as required for the protection of the work from the beginning of the work until final completion, acceptance, or occupancy. Methods and extent of protection and heating shall be subject to the State's Approval.

PERMITS

The State will furnish the building permit, if required.

The Contractor shall obtain and pay for all other licenses and permits and shall pay fees and charges for connection to outside services to include, water sewer and electricity and use of public or private property for storage of materials, etc. The Contractor shall comply, without additional expense to the State, with all State, County and Municipal building ordinances and regulations insofar as the same are binding upon the State. ITD will reimburse the contractor for utility hookup fees at invoice costs.

CLEANING UP BUILDING

In addition to removal of rubbish and leaving the building rooms clean, the Contractor shall remove stains, spots, marks and dirt from decorated surfaces, clean hardware, remove paint spots and smears from all surfaces and clean fixtures, clean all glass; replace any broken glass.

PROTECTION

The Contractor shall, at all times, protect excavation, trenches and building from damage or cave-in; provide pumps, equipment or enclosures as required; remove and replace with new work any work damaged by failure to provide protection; provide and maintain guard lights at barricades, obstructions, trenches or pits adjacent to public thoroughfares. Replacement of damaged work will be at no additional cost to the Owner.

CODES

Contractor, including subcontractors, shall submit his bid in accordance with plans and specifications. If plans and specifications do not comply with any codes having jurisdiction in that particular place or construction, Contractor shall submit alternate price on any changes necessary to comply with such codes. If such alternates are not stated in bid, it shall be assumed that Contractor's base bid includes, to the best of his knowledge and experience, all work necessary to comply with such codes.

PRIOR APPROVAL

The references made to materials equipment, appliances or fixtures in the plans or these specifications, where manufacturers' products or brand names are specified, are made to show

SPECIAL PROVISION
IDAHO BUILDING

PRIOR APPROVAL

standards for comparison only as to type, design character, or quality of the article desired, and are not for the purpose of restricting bidders to these products or brand names.
The term "or equal" as used herein shall be understood to mean equal to that specified for fulfilling the intended requirements in the judgment of the Engineer. THE BURDEN OF PROVING THE EQUALITY SHALL BE THE CONTRACTOR'S RESPONSIBILITY. The Engineer's decision shall be final. Shop drawings or manufacturer's literature for the substitute item and for the specified item shall be submitted to support the Contractor's requests on all substitutions.

All requests for approval of change in design of function of materials specified must allow 14 days review time, after receipt of all necessary documents, by the Engineer. Approval of submittals shall not relieve the Contractor from responsibility for deviations from the plans or specifications, unless he has, in writing, called the Engineer's attention to deviations at the time of submission, and obtained his written approval. Approval of submittals does not relieve the Contractor from responsibility for errors in shop drawings or literature.

SUBMITTALS

Minimums of five (5) complete submittals are required on all products, unless more are required in the Architectural Specifications.

Submittals shall contain:

Project name and number

1. Date of submission and dates of any previous submissions.
2. The names of the contractor, sub-contractor and manufacturer.
3. Contractors stamp, initialed or signed, certifying to review of submittal.
4. Identification of any deviation from Contract Documents.
5. Identify each submittal item by specification section, manufacturer, brand, trade name, number, size, rating, or whatever other data is necessary to properly identify and check materials and equipment. The words “as specified” are not sufficient identification.

AS-BUILT DRAWINGS

The Contractor shall provide the Engineer with three (3) complete sets of as-built drawings. As-built drawings shall provide detailed and accurate sizes, dimensions and locations of all work items covered under this contract. Contractor shall instruct the separate trades to keep accurate measurements and records of their installation, as the work proceeds. No measurement or payment will be made for as-built drawings, but the cost thereof shall be considered incidental to the items of work under this contract.

SPECIAL PROVISION
IDAHO BUILDING

OPERATION, MAINTENANCE INSTRUCTIONS AND MANUALS

Train owner's personnel in the general use and maintenance of all installed equipment and accessories. Provide three complete copies of "Operations and Maintenance" manuals for the owner's use. Manuals will identify all parts of equipment and show complete wiring diagrams. Manuals will include copies of warranties for all items.

WORK NOT NOTED, DETAILED OR SPECIFIED (Revised 9/29/03)

All work required for complete installation or assembly shall be included in the Contractor's bid. Where minor portions of required work are not noted, detailed, or specified, such work shall be done in accordance with proven construction practice or accepted industry standards at no additional cost to the owner. The Contractor shall be held responsible for verification of existing job conditions prior to bid. No additional cost shall be awarded to the successful contractor (or their subcontractors) after bids have been submitted and contracts awarded for failure to verify existing field conditions. Discrepancies between actual field conditions and contract documents shall be brought to the Architects/Engineers attention for alternative methods of installation prior to the bidding of this project.

DIMENSIONS AND MEASUREMENTS

The Contractor shall field verify all dimensions pertaining to the work and shall be responsible for the determination of all quantities of materials required for the work and for the accuracy of all dimensions of materials and items fabricated for this project. The Contractor shall not rely on the scale drawings in the project drawings for the determination of exact quantities or dimensions.

PERFORMANCE

Contractors interested in bidding this project shall carefully inspect the project prior to submitting his bid. Submission of a bid by any Contractor shall be accepted as prima facie evidence that he has examined these specifications and has satisfied himself as to the nature and location of the work and all other matters, which can in any way affect the work or cost thereof under the contract. Any failure of the Contractor to acquaint himself with all available information, including a physical survey of the site of the proposed work, shall not relieve him from successfully performing all the work required for a complete finished job.

BID SCHEDULE

All of the items shown or noted on the plans or in these specifications, which are not specifically a bid item, are considered incidental items. The cost of furnishing and installing all incidental items will not be paid for separately, but shall be included in the contract unit prices as bid, unless otherwise noted.

SPECIAL PROVISION
IDAHO BUILDING

COORDINATION AND CONTROL

This work shall proceed in an effective sequence so as to eliminate unnecessary work stoppages at the building.

SUPERINTENDENT

The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during the progress of work. The superintendent shall be satisfactory to the Architect, and shall not be changed except with the consent of the Architect unless the

Superintendent proves to be unsatisfactory to the contractor and ceases to be in his employ. Under this circumstance, the new superintendent shall also be satisfactory to the Architect. The superintendent shall represent the Contractor and all communications given to the superintendent shall be as binding as if given to the Contractor. Important communications will be confirmed in writing.

SPECIAL PROVISION ITEMS - MEASUREMENT AND PAYMENT (SP-1 & SP-2) & (SP-1 & SP-3)

The accepted quantities of all Special Provision Items hereinafter specified will be measured by the units shown and paid for at the contract unit prices for such items, which price shall be full compensation for all material, labor, equipment, tools and incidental expense necessary to complete the item except as otherwise noted.

OWNERS USE OF BUILDING (Addition 12/1/03)

Owner reserves the right to occupy and/or use the building or portions thereof, including portions during the construction period and prior to final acceptance. Such occupancy and/or use shall not constitute acceptance of the Work or any part thereof. The contractor shall take special care to insure that no unnecessary disruptions or normal routines will occur at the project work site. Access to and egress from buildings, grounds, services areas, drives, and streets shall be maintained at all times. Temporary disruptions of building services, equipment, etc… shall be scheduled with the Owner. Normal functions shall be restored as quickly as possible.

SP-1: CONSTRUCT METAL MAINTENANCE BUILDING, (COUNCIL)

Description: This item shall consist of the design and construction of one (1) concrete and rigid frame metal type building including all mechanical, electrical and yard improvements as shown on the plans and described in the Architectural Special Provisions.

Dimensions are nominal and minor changes necessary to accommodate suppliers' modular designs may be accepted by the Engineer.

The Contractor shall furnish and install all necessary parts and accessories required for complete metal building and other items essential for the complete project.

The metal building shall be equal to the R & M Steel, Varco-Pruden, B & C Building Systems, Wedgcor, American Steel Building or HCI Building Systems as described in these specifications.

All finish grading and site finish work 10'-0" outside of the roof line will be accomplished by State Forces. All finish grading and site finish work within 10'-0" of the outside roof line will be completed by contractor. Contractor shall be responsible for proper utility trenching and backfill regardless of location.

Construction Requirements. The following design parameters apply to the respective location. The successful bidder shall show certified engineering proof, by a professional civil engineer licensed in the State of Idaho, that the structure will support these loads.

Council: Ground Snow Load – 80 PSF
Wind Load – 90 MPH , 3 second gust, Exposure C
Minimum Footing Depth – 36 In. or pinned into solid basalt
(see Foundation Report)

The basic design is for a building of metal construction with rigid frame support members The walls and ceilings shall be insulated and finished as shown on the plans and described in the Architectural Special Provisions. All metal panels shall be factory painted. Girts and purlins spacing shall not exceed 4'-0" on centers. Exterior wall panels shall be 26 gauge minimum and interior wall panels shall be 26 gauge minimum. Roof panels shall be 24 gauge minimum.

Method of Measurement: Measurement will be on the lump sum basis for the construction of the concrete and metal building in place and in accordance with the plans and specifications.

Basis of Payment: The accepted quantities will be paid for at the contract unit price for the item listed below:

Payment will be made under:

Pay Item	Pay Unit
SP-1 Construct Metal Maintenance Building, (Council)	Lump Sum

SP-2 DESIGN AND CONSTRUCT METAL SAND STORAGE BUILDING (COUNCIL) (OPTION 1)

Note: Contractor to bid sand option 1 and/or option 2. ITD will build a maintenance building and a sand shed. ITD will select sand shed type (option 1 or 2) deemed to be in the best interest of the State.

Description: This item shall consist of the design and construction of one (1) sand storage building 72 ft. x 100 ft. The design weight of the stored material in the sand shed will be 130 lbs /cubic foot with a natural angle of repose of 33°.

The Contractor shall furnish and install all necessary parts and accessories required for a complete sand storage building.

All finish grading and site finish work 10'-0" outside of the roofline will be completed by State Forces. All finish grading and site finish work within 10'-0" of the outside roof line will be completed by contractor. The Contractor shall be responsible for the foundation excavation, utility trenching, boring, and backfill regardless of location.

Construction Requirements: The following design parameters apply to the respective location. The successful bidder shall show certified engineering proof, by a professional structural engineer licensed in the State of Idaho, that the structure and foundation design will support these loads.

Design loads according to the 2003 International Building Code
Ground Snow Load: 80 PSF
Wind load: 90 MPH, Exposure C
Minimum Footing Depth – 36 In.(see Foundation Report)
Flood loads are non-applicable to this project.
Use Materials Foundation Investigation Report. Refer to Foundation Report Investigation Addendum for excavation and backfill requirements.

The building is exempt from seismic requirements, equivalent to an agricultural storage structure which is intended for incidental occupancy.

Method of Measurement: This item will be measured by the lump sum for construction of the buildings complete in place, including all materials, labor, equipment and site work.

Basis of Payment: The accepted quantity of this item will be paid for at the contract unit price for the item listed below.

Payment will be made under:

Pay Item:	Pay Unit:
SP-2 Design and Construct Metal Sand Storage Building (Council)	Lump Sum

SP-3 DESIGN AND CONSTRUCT FABRIC COVERED SAND STORAGE BUILDING (COUNCIL) (OPTION2)

Note: Contractor to bid sand option 1 and/or option 2. ITD will build a maintenance building and a sand shed. ITD will select sand shed type (option 1 or 2) deemed to be in the best interest of the State.

Description: This item shall consist of the design and construction of one (1) fabric covered sand storage building 72 ft. x 100 ft. The design weight of the stored material will be 130 lbs /cubic foot with a natural angle of repose of 33°.

The Contractor shall furnish and install all necessary parts and accessories required for a complete sand storage building.

All finish grading and site finish work 10'-0" outside of the roofline will be completed by State Forces. All finish grading and site finish work within 10'-0" of the outside roof line will be completed by contractor. The Contractor shall be responsible for the foundation excavation, utility trenching, boring, and backfill regardless of location.

Construction Requirements: The following design parameters apply to the respective location. The successful bidder shall show certified engineering proof, by a professional structural engineer licensed in the State of Idaho, that the structure and foundation design will support these loads.

Design loads according to the 2003 International Building Code

Ground Snow Load: 80 PSF
Wind load: 90 MPH, Exposure C, Importance Factor .87,Category I
Flood loads are non-applicable to this project.
Use Materials Foundation Investigation Report. Refer to Foundation Report Investigation Addendum for excavation and backfill requirements.

This building is exempt from seismic requirements, equivalent to an agricultural storage structure which is intended for incidental occupancy.

Method of Measurement: This item will be measured by the lump sum for construction of the building complete in place, including all materials, labor, equipment and site work.

Basis of Payment: The accepted quantity of this item will be paid for at the contract unit price for the item listed below.

Payment will be made under:

Pay Item:	Pay Unit:
SP-3 Design and Construct Fabric Covered Sand Storage Building (Council)	Lump Sum

I N D E X

ARCHITECTURAL
SPECIAL PROVISIONS

2.0 General

The building site will be graded by State Forces to an approximate 0.5' above or below shop floor elevation. The Contractor shall complete foundation and other miscellaneous excavations and backfill as required.

2.1 Excavation

Excavation shall be made in accordance with the applicable provisions of Section 210 - Excavation for Structures, and shall include all excavating and backfilling of sewers, water, plumbing, heating and electrical work. Provisions shall be made for the installation of all work as the building progresses. Cutting and patching to install omitted work shall be avoided.

Excavation shall be made to the indicated elevation or dimension plus sufficient space to permit erection of forms and shoring, to allow proper installation of below-grade materials, and to allow proper inspection of foundations and below-grade installations. Excavations shall be shored and braced if necessary to prevent cave-in. Such shoring and bracing shall be removed before backfill is completed, but not until permanent supports are in place. Excavations shall be kept free from water.

2.2 Fill

Material under footings and foundations shall be compacted to the requirements of Class A in accordance with ITD Standard Specifications, Section 205 - Excavation and Embankment. All backfill around foundations and footings shall be an approved granular material placed and compacted to the requirements of Class A by the Contractor in accordance with Section 205.

Trash shall not be allowed to accumulate in spaces to be backfilled; such spaces shall be thoroughly cleaned before backfill is placed therein. Frozen particles, large stones, vegetable matter, or trash shall not be used in fill or backfill.

Fill, which is exterior to the building site and not under Portland cement concrete, except driveways and approaches, will be considered non-load-bearing. Non-load-bearing fill shall be placed in layers of not more than 12-inch loose measurement and thoroughly compacted. Driveway and approach fills shall be compacted in accordance with all applicable provisions of ITD Standard Specifications, Section 205-Compaction, Class A Compaction.

No fill or backfill shall be placed without approval.

The Contractor shall conduct work in an orderly manner and so as not to create a nuisance. Dirt shall not be permitted to accumulate on streets or sidewalks nor to be washed into sewers.

The Contractor shall remove from the site and legally dispose of all debris. Excavated material not required for fill shall be removed or spread on the site as directed.

2.3 Irrigation System

Non-Applicable

2.4 Yard Improvements

Non-Applicable.

2.5 Soil Preparation

No waste concrete, mortar, or building materials are to be buried on the site. They shall be removed by the Contractor.

2.6 Lawns

Non-Applicable

2.7 Ground Cover and Plants

Non-Applicable

2.8 Trees and Shrubs

Non-Applicable

2.9 Railroad Work

Non-Applicable

2.10 Septic Systems

Septic system shall be installed per Architectural Drawings. Septic tank shall 1500 gallon as manufactured by Boise Vault, or approved equal.

Leech field drainage shall be standard Infiltrator chamber as manufactured by Infiltrator Systems Inc., or approved equal.

Drainage rock shall be 2” gravel for base and chamber cover. Drainage Geotextile shall cover leech field before backfill is placed.

All work shall comply with Adams County Health District requirements.

3.0 General

Portland cement concrete shall meet the requirements of class 30 with 3000 PSI minimum compression strength.

Minimum Cement Content - 560LB
Maximum Water Cement Ratio - .49
Maximum Slump Inches - 5"
Air Content Percent - 6.5 ± 1.5%

Vapor barrier shall be 0.010-inch (10 mil) polyethylene film, "Visqueen" or approved equal. Lap 3" minimum and tape tight at all seams and protect from damage. Vapor barrier shall provide total underslab coverage.

3.1 Finishing Concrete

Interior concrete slabs shall receive a smooth steel trowel finish. Exterior concrete slabs shall receive a surface finish in accordance with Section 502.03(I) using a soft bristle broom. Concrete slabs shall be water cured in accordance with Section 502.03(J). Water curing shall begin after the concrete surface has set up enough so it will not be damaged. Water curing shall consist of keeping the concrete surface continuously wet for a period of five days. Application of Marc 278 Klear Krete as manufactured by Mid-American Research Chemical Corp., Columbus, Ohio or approved equal shall be made just prior to occupancy. Surface must be clean and free of dirt, dust, and debris. Apply at 400 sq. feet per gallon with recommended application methods.

Interior and exterior exposed concrete foundation walls shall be finished to provide rubbed surface finish(sack finish) as detailed in Section 502.03 I (2).

3.2 Form Work

Suitable and adequate wood or metal forms shall be used for contact surfaces, conforming to shapes, lines, grades and dimensions of concrete shown on drawings. Mortar-tight, well-braced ties and supports shall be used to maintain desired position during and after placing concrete, designed for removal without injury to concrete.

Undressed lumber will be permitted for form work, except for permanently exposed exterior and interior "finished" surfaces.

Double form all footings with boards. Earth forms are not acceptable, except as indicated or approved. Before any concrete placement is started, the form work shall be cleaned of chips, trash, and sawdust.

Sand shed pier forms shall be non-perforated N-12® Pipe, as manufactured by Advanced Drainage Systems Inc., of Columbus Ohio.

3.3 Concrete Tests

6" X 12" cylinders will be taken at the point of placement in the forms for all plain and reinforced concrete, at the discretion of the Engineer and will be taken by State Forces.

Cylinders will be tested in accordance with AASHTO methods by the State Laboratory.

3.4 Reinforcement

Reinforcing bars shall meet the requirements of ITD Standard Specification, Section 503, Epoxy coated metal reinforcement.

3.4.1 Support For Reinforcement

Concrete blocks shall be used in slabs supported on earth.

Metal wire ties shall be used for formed members or walls.

3.5 Location of Conduits & Piping at Floor Slabs On Grade

All electrical conduit which is run in the floor slabs shall be placed under the reinforcing mesh and is to be taped. Minimum concrete coverage over the top of any conduit shall be 2". Depress the bottom of the floor slabs and membranes at any conduit cross-overs or larger conduit which reduces concrete coverage to less than 2".

3.6 Control Joints

All control joints shall be metal keyway. Saw cuts are not allowed.

3.7 Concrete Block

Sand shed concrete block work shall consist of stacked concrete type LOCK-BLOCK as manufactured by Ultrablock Inc., or an approved equal.

Top layer of block shall be flat top.

General Specifications

Size:	29.5” x 29.5” x 59” approx. 2.5’ x 2.5’ x 5’
Weight:	Approx. 4320 lbs.
Clearance Around Key:	½”. The chamfered corners to provide 8 inches of drainage area per block.
Lift Provisions:	A standard 7 strand steel loop at top center of the top of block (rebar is not acceptable material).

Surface Finish:	Standard grade smooth finish without large blemishes.
Concrete Strength:	Blocks manufactured using surplus concrete rated at 2500 psi to 4000 psi.
Perpendicular Interlock	Block must be able to lock in line and perpendicular.
Steel Tie Plates	Steel tie plates on block interior are not acceptable.

3.7.1 Damp-proofing for Sand Shed

All exposed interior concrete and the top of the concrete block/piers is to be protected with Met-Con 3000 as manufactured by Romar Industries, 2109 East Rockhurst, Springfield, Mo. 65802 or approved equal shall be applied just prior to occupancy. Surface must be clean and free of dirt, dust, and debris. Product shall be spray applied per manufacturers instructions.

Met-Con 3000 shall also be applied to all exposed red steel up to the first girt.

5.0 General

The following standard specifications govern the design, fabrication and erection of structural steel: "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings of the American Institute of Steel Construction."

"Structural Steel" includes the following categories of parts: bases, anchors, lintels, bearing plates, connectors, and all miscellaneous structural items.

5.1 Material

Structural Steel shall conform to the requirements of ASTM A36, Structural Steel.

The architecturally exposed structural steel's permissible tolerance for out-of-square or out-of-parallel depth, width and symmetry of rolled shapes shall conform to ASTM A36. Overall profile dimensions of built-up members shall be adequate to provide for the accumulated permissible over-run of the component parts.

The as-fabricated straightness tolerance of members shall not exceed one- half of the standard camber and sweep tolerances in ASTM A36.

5.2 Fabrication

Fabrication shall be performed with special care and necessary straightening to maintain the condition of the material as described above.

Shop details shall show clearly the required fabrication tolerances. Erection plans and/or anchor bolt plans shall show the required tolerances for setting embedded items.

Standard commercial products, conforming to requirements of Drawings and Specifications, may be used subject to approval of Engineer. Bolt with proper size bolts. Nuts shall be drawn tight and end thread upset. Screw and bolts shall be standard and washers provided where necessary.

Build anchors and other connection members required into the concrete as work progresses to avoid unnecessary cutting and drilling.

All work shall be executed by skilled metal workers and certified welders. Only such work that cannot reasonably be performed in the shop shall be done at the site. Cuts, bends, punching and drilling shall be neatly and properly located. All parts exposed to view shall be ground and filed smooth. Exposed surfaces shall be free of fabrication marks. Members shall be true-to-length to allow assembly without fillers.

ALL welding shall be in accordance with AWS Specifications. "Galvaweld" or equal shall be applied to any surfaces welded after galvanizing.

Fabrication of all structural steel shapes shall conform to AISC standards.

5.3 Painting

Before leaving the shop, all steel work shall be cleaned by hand wire brushing, or by other means elected by the fabricator, of loose mill scale, loose rust, accessible weld slag or flux deposit, dirt and other foreign matter. Oil and grease deposits shall be removed by solvent. All galvanized metal will be clean and free of defective coating before leaving shop.

After cleaning all steel work shall be given one coat of shop paint applied thoroughly and evenly to dry surfaces by brush, spray, roller coating, flow coating or dipping at the election of the fabricator.

Surfaces within two inches of any field weld location shall be free of materials that would prevent proper welding or produce objectionable fumes while welding is being done. If shop painted, surfaces to be welded shall be wire brushed in the field before welding to reduce the paint film to a minimum.

5.4 Erection

The erector shall plan and execute the erection in such a way that the fit and appearance of the joints and the structure as a whole will not be impaired.

5.5 Material Delivery

The Contractor shall arrange for delivery of fabricated structural steel in such sequence as will permit the most efficient and economical performance of this work permissible within the scope of requirements in the overall performance of the construction contract.

5.6 Shop Drawings

Five (5) copies of all shop drawings shall be submitted for approval. Approved or noted drawings will be returned to the Contractor within fifteen (15) days.

Shop drawings so prepared and approved are deemed to represent the correct interpretation of the work to be done. Contractor shall furnish all necessary templates and patterns required by other trades and supervise and be responsible for proper location and installation of built-in items.

5.7 Open-Web Joists

Non-Applicable

5.8 Metal Decking

Non-Applicable

5.9 Miscellaneous Metal Framing

The Contractor shall furnish for approval, five (5) copies of shop drawings for the following items:

5.9.1 Exterior Door Guards (Bollards)

Exterior Door Guards shall be 6-inch steel pipe of 1/4" wall thickness, 8-foot long placed in the concrete with 5-feet exposed and filled with concrete as detailed on the drawings.

5.9.2 Interior Door Guards (Bollards)

Same as exterior door guards.

6.0 General

The following standards apply to work in this Section except where more stringent requirements are specified herein: Architectural Woodwork Institute "Quality Standards", Western Wood Products Association Manual, and American Wood Preservers Association Specifications.

Verify all dimensions shown on Drawings by taking field measurements; proper fit and attachment of all parts is required.

Coordinate with all other trades as required to complete work to satisfaction of the Engineer.

Grading rules governing lumber and millwork shall be as follows:

- Soft wood shall conform to the standard grading and dressing rules of Western Wood Products Assoc.

- Framing and all other structural lumber shall conform to timber construction standards of the American Institute of Timber Construction ATG 100.

Grade Mark, Trade Mark and Mill Identification Mark of the respective associations having jurisdiction shall appear on each piece of lumber, or each shipment shall be accompanied by a certificate of inspection.

Maximum moisture content shall be as follows:

Plywood 19%
Rough & Framing Lumber 19%

Framing and finish lumber shall be stored elevated from immediate contact with the earth and shall be covered for protection against rain and moisture.

6.1 Rough Carpentry

6.1.1 Materials

Plates shall be of Douglas Fir and Larch No. 2 or better treated and dimensioned. 1700f single plates shall be provided at floors and bottoms of all openings. Double plates shall be provided at ceilings and heads of openings, unless otherwise detailed. Plates shall be arranged to form continuous horizontal ties. Single plates shall be spliced; ends of double plates shall be staggered. Steel straps shall be provided where plates are cut to accommodate ducts or pipes.

Studs shall be of Douglas Fir or Larch No. 2 or better, dimensioned. All studs shall be spaced 16" on center unless otherwise noted on the plans, or required for ducts and pipes. At all corners, three studs shall be arranged so as to provide end nailing for surfacing materials. At openings, corners and intersections, studs shall be double with the inside stud shortened to receive headers and lintels. One row of solid bridging (fire blocking) shall be provided every 4' in all bearing walls or partitions.

Provide 2 x 8 solid backing for wall stops at each door, for wall mounted urinal, urinal screen, sink, and for break room cabinets.

Ceiling Joists shall be of Douglas Fir, No. 2 or better, selected for proper crown and condition. Joist hangers shall be Simpson "u" Type standard joist hangers, or equal. Provide solid blocking as required by code. Notching, drilling, and cutting shall be allowed only as specified by the 2003 International Building Code.

Decking (Flooring) shall be 3/4" APA rated Sturd-I-Floor, Exp. 1 plywood with T & G edges. Plywood shall be screwed and glued to all ceiling joists.

Interior wall sheathing shall be 5/8” APA rated B-C, exterior exposure plywood.

6.1.2 Rough Hardware

Nails, spikes, screws, and bolts and other rough hardware shall be provided as necessary for proper erection of framing and installation of carpentry and millwork.

Size and quantities of hardware must be sufficient, as judged by the Engineer to draw and hold members rigidly and permanently in place.

6.1.3 Framing

Sills, sleepers, nailing blocks, rough bucks, and all other wood in permanent contact with masonry or concrete shall be treated with two coats of Cuprolignum as manufactured by Rudd Paint and Varnish Co., 1608 Fifteenth Avenue, West Seattle, Washington. Contractor may use lumber which has been pressure treated with Chemonite or Kolman Salts, or construction grade redwood.

Framing shall be erected true to line and dimensions, square and plumb, in accordance with the plans. All framing shall be adequately braced. Workmanship shall be in accordance with the best practices of the trade.

All framing shall be thoroughly nailed or spiked. Minimum nailing shall be two nails per member at each support. Nailing shall conform to the schedule as outlined in the 2003 International Building Code.

Sills shall be set level and true on the foundations. Unless sills form a continuous contact with the foundations, they shall be bedded in a grout of 1 part cement and 3 parts sand, or with an approved Fiberglass sill sealer. Sills shall be anchored with bolts as shown on the plans. Nuts shall be drawn tight against metal washers.

Solid nailing blocks shall be provided as required for each attached installation. Backing of nominal 2" material securely fastened shall be provided for plumbing fixtures, toilet partitions, mirrors, hardware, door stops, bumper blocks, and similar accessories.

Fire stopping shall be of nominal 2" thickness by width of the studs. Where pipes or ducts pass through wood construction, fire stops shall be made of non-combustible material (rock wool & fire safe chaulking). Fire stops shall be arranged to cut off all concealed draft openings, and to form an effective fire barrier between roof spaces, etc.

6.2 Finish Carpentry

Supply and install complete finish carpentry work as shown on Drawings and as specified herein, to include but not be limited to the break room cabinets, window casing, moldings, and window stock. Window trim, casing, stools, and molding material shall be S4S clear pine or clear mahogany.

6.2.1 Finish Carpentry Installation

Only hot dip galvanized or aluminum finish or casing nails shall be used. Set nails for putty stopping in surfaced members. Hammer marks not acceptable on any exposed finished surface and may be cause for rejection of work.

All end splices exposed in finished members shall be bevel splices and not square butted. Members shall be installed in as long lengths as possible.

Finish carpentry work shall be installed to details shown, plumb, level and to line and securely anchored. Make scribes where required accurate. Miter corners of trim.

Provide and install other miscellaneous millwork items and related work required to complete work of this Section.

All woodwork shall be prepared and installed hereunder by cleaning and sanding as required to receive finishes specified.

6.2.2 Cabinets

Sheet materials for casework shall be Permalam Thermset Decorative panels, polyester or melamine resin impregnated web, pressure bonded and thermally fused to a core 45 pound wood particle board; all exposed surfaces including but not limited to door and drawer surfaces, drawer construction, gables and backs and shelving.

Laminate Materials:

A. Plastic Laminate: AWI,0.050 inch, General Purpose quality for countertops

B. Plastic Laminate: AWI,0.038 inch, for all exposed vertical surfaces of casework. Approved Manufacturers: Wilsonart Inc. Formica Corp. Color choice by the Engineer from manufacturer's color charts consisting of actual units showing full range of colors and textures.

Hardware:

A. Standards: Hardware: ANSI/BHMA A156.9 American National Standard for Cabinet Hardware.

B. Adjustable Rests and Shelf Standards: Equal to Blum 34.0040.

C. Drawer and Door Pulls: 4" Brushed aluminum wire pulls.

D. Drawer Glides: Epoxy coated, side mount, full extension, captive nylon wheel, 75 pound capacity.

E. Hinges: Self closing, adjustable, concealed with 170 degree opening standard. Approved Manufacturers: Blum
Melpa
Hafele
Grass
Approved Equal

6.2.3 Fabrication

Shop assemble casework for delivery to site in units easily handled. Fit shelves, doors drawer fronts, and exposed edges with plastic edge trim. Use one piece for full length only.

Drawer fronts shall be a minimum of ¾" thick thermoset decorative overlay style, sides and back ½" thick thermoset decorative panel with lock shoulder joint glued and nailed. Drawer bottoms shall be a minimum of ¼" thick thermoset decorative panel dadoed into front and sides, glued and nailed into back.

Doors shall be a minimum of ¾" thick thermoset decorative panel overlay style.

Shelves under 30" wide shall be a minimum of ¾" thick thermoset decorative panel.

7.0 GENERAL

This division of the specifications includes the following unless specifically exempted: waterproofing, roof insulation, roofing, sheet metal work, flashing, roof accessories, metal fascia, and caulking and sealants.

7.1 Dampproofing

Exterior below grade concrete walls are to be protected with Sealtight Sealmastic as manufactured by W.R. Meadows, Inc., or an approved equal, applied per manufacturer's specifications.

7.2 Building Insulation

Building insulation shall be stored in sealed containers in warehouses or at jobsite until used. Allow no open containers of building insulation to be exposed to conditions of moisture.

Opened containers of insulation left exposed to the elements shall be removed from the jobsite if so deemed necessary.

All insulation shall be installed in strict accordance to the manufacturer's printed instructions.

7.2.1 Blanket Insulation (Exterior Walls)

Walls shall have a thermal barrier between siding and steel frame per 7.2.5 Exterior Wall Thermal Barrier. Wall insulation shall be 6" of fiberglass batt with vinyl faced vapor barrier placed between the girts with an "R" value of 19. Secure continuously to frame work with tape. The vapor seal surfaces shall be protected during construction to ensure that the vapor seal is not eliminated. Repair all damage to the vapor seal with proper materials as recommended by the insulation manufacturer.

7.2.2 Rigid Insulation

Rigid foundation wall insulation shall be 2" thick Styrofoam brand Square Edge with "R" value of 10, and a compressive strength of 25 pounds, as manufactured by Dow Chemical Co. Mastic adhesive shall be Dow General Purpose Mastic No. 11 as distributed by the Dow Chemical Co.

Rigid insulation shall be installed as indicated on the plans or in accordance with the manufacturer's recommendations. Mastic adhesive shall be applied in accordance with labeled instructions, equals by approval only.

Rigid floor insulation shall be 2" thick Styrofoam brand Highload 40 as manufactured by Dow Chemical Co.

7.2.2.1 Floor Insulation (option)

As an option to rigid floor insulation, The contractor may use a insulation tarp. Insulation tarp shall be Insul-Tarp as manufactured by Insulation Solutions Inc., or an approved equal. Under-slab vapor barrier can be eliminated with the use of an insulation tarp.

7.2.3 Roof Insulation

Rigid ceiling insulation material is to have a Class I flame spread, and shall be 2 layers of 2" "Thermax Insulation Board" as manufactured by Celetex Corp., or equal with an "R" value of 28. Insulation board to be installed in a staggered configuration. The material shall have a factory applied foil coating on each surface. Insulation board shall be installed securely to top of metal purlins with Buildex Multi Diameter Insulation Teks with 1-1/4" poly washers and cover caps spaced 12" o.c. along purlins. All exposed interior joints and all exterior joints on the first layer of insulation shall be sealed with 2" Thermax foil faced tape as recommended by manufacturer.

Blanket insulation over office areas shall be 6" fiberglass vinyl or Kraft faced with an "R" value of 19, placed between the ceiling joists as detailed on the plans.

7.2.4 Separation Wall Insulation

Insulation for the interior separation walls of the office area and shop area shall be 3 1/2 inch or 6 inch faced insulation placed between the studs of the separation walls as shown on plans. Insulation to be equal to Owens-Corning Fiberglass having an "R" value of 11 or "R" value of 19. Faced vapor barrier shall be placed on the office side.

7.2.5 Exterior Wall Thermal Barrier

Thermal barrier insulation for steel frame walls shall be 3/4” thick Styrofoam brand Square Edge with an “R” value of 3.7, as manufactured by Dow Chemical Co., or 1/4” Low-E insulation with an “R” value of 7.75 as manufactured by Environmentally Safe Products Inc. Insulation to be cut in strips 2” wider than the width of the girts and placed continuously between the girts and exterior metal siding using two sided tape.

7.3 Shingles & Roofing Tiles

Non-Applicable

7.4 Preformed Roofing & Siding

See Division 13

7.5 Membrane Roofing

Non-Applicable

7.6 Metal Roof Flashing and Trim

Flashings shall be installed at all intersections of roofs, at all projections through roofs and elsewhere, as shown on the drawings, or required to provide watertight protection. Exposed edges of all flashings shall be folded back 2" to provide stiffness. Cap flashings shall be provided over all base flashing.

Flashings shall extend up vertical surfaces not less than 4 inches.

Pipe and conduit protruding through the roof as provided under other parts of these specifications shall be flashed with flexible, weather-resistant, EPDM one-piece construction pipe flashings designed to fit pipes from sizes 3” through 18” inch diameter (Dektite) as manufactured by ITW Buildex. Installation per manufacturer’s instructions.

Metal stop and drip shall be 26 ga. G.I. in maximum 8' lengths, fabricated in accordance with details and shop painted.

7.7 Fascia Covering

See Division 13

7.8 Roof Accessories

Prefabricated curbs, or necessary framing crickets for all exhaust vents shall be provided. Refer to drawings for locations.

7.9 Caulking & Sealants

Acrylic sealant shall be an acrylic terpolymer resin based compound with a minimum 90% solids content, conforming to the requirements of Federal Specification TT-S-230. The color shall be appropriate to the installation.

Suitable materials for back-up shall be untarred oakum, fiberglass, polyurethane foam or polyethylene rope. No oily or asphaltic type materials may be used. The fill shall be uniform to provide the sealant depth required.

Extruded polyisobutylene tape CL-50 as manufactured by Chemical Sealing Corp. is an approved product.

Gun type caulking compound shall be an elastic water-proof adhesive equal to General Electric Silicone Rubber, or Dow-Corning 780, or "Horuflex" by W.R. Grace Co.

Completely seal with caulking compound all joints around frames and sills of doors and windows and other openings in exterior walls. Caulk around all openings for mechanical installations. All exterior joints between metal shall be sealed weather-tight.

7.9 Caulking & Sealants (contd.)

All surfaces shall be clean, dry and free of dust, oil, grease, dew or frost. Porous surfaces require priming. Receive Engineer's approval that surfaces receiving sealant have been cleaned and primed per manufacturer's recommendations before sealing. Sealing surfaces shall be free of wrinkles and skips, uniformly smooth and with perfect adhesion along both sides of joint.

8.1 Metal Doors & Frames

This section shall encompass work described below under hollow metal doors and frames.

All doors shall be provided and installed under this section of the specifications by the Contractor. Hardware for all such items shall be furnished under this section and the hardware section of the specifications. Unless otherwise specifically stated, all finish hardware shall be installed by the Contractor. Doors shall be delivered to the construction site in a condition ready to receive hardware in accordance with that specified.

Approved Manufacturers - Fenestra, Inc., Detroit, Michigan; Kewanee Mfg. Co., Kewanee, Illinois; Amweld, Miles, Ohio; Steelcraft Mfg. Co., Cincinnati, Ohio.

Workmanship shall be of the highest quality and in conformity with the best known standards of the trade. All work shall be shop fabricated to required profiles by forming and welding with corner angles and edges straight and sharp unless covered by bull nose, etc.; fit and fabricate accurately with corners, joints, seams and surfaces free from warp, wave buckles or other defects.

Provide frame as detailed. Make all breaks and angles uniform, straight and true. Corners shall be mitered, accurately fitted, welded full length and ground smooth.

All exposed surfaces shall be cleaned, phosphatized and given one baked-on shop coat of gray synthetic primer.

Doors shall be fitted, hung and trimmed in accordance with the plans and these specifications. Doors shall have 1/16" clearance over thresholds unless otherwise directed by the Door Schedule. Doors in openings without thresholds shall have 3/8" clearance at bottom. Doors 1-3/4" or greater in thickness shall have the lock or latch edge beveled at the rate of 1/8" in 2". Doors shall be hung and trimmed with hardware as specified in Section 8.5. Locks with standardized cases shall be installed at the same height.

All finished frames and doors shall have no visible holes from temporary hardware used by the Contractor prior to the final hardware.

Submit five (5) copies of shop drawings in accordance with General Conditions (for both doors and frames).

8.1.1 Hollow Metal Doors and Frames

A. Hollow Metal Doors

Hollow metal doors shall be insulated type fabricated from two (2) sheets of 18 gauge steel with no visible seams on either face. Welds on 2" centers shall occur around the perimeter of the door.

Sound and heat insulation shall be secured by bonding a pre-cured structural foam core to the panels with a thermosetting adhesive. Rigid core shall be one pound density, odorless, self-extinguishing material that is resistant to vermin, fungus, bacteria, moisture, mildew and rot, R-7 rated.

Doors shall be reinforced, drilled and tapped to receive hardware as specified in the hardware schedule. Doors shall be reinforced for specified surface applied hardware; drilling and tapping shall be complete. Hinge reinforcing plates shall be #6 gauge. Reinforcing for other surface hardware shall be #14 gauge except for closer reinforcing, which shall be #12 gauge.

Unless otherwise specified, the locations of the locks, latches, push-pull plates and bars, exit devices, handle sets, closer reinforcing, roller latches and arm pulls shall conform to the recommendations of the National Builders Hardware Association.

All doors shall be individually packaged in cartons completely covering entire door to prevent damage or marring of the finish. Doors shall be stored in an upright position under cover on the building site on wood sills or on floors in a manner that will prevent rust and damage. Avoid creating a humidity chamber by using a plastic or canvas shelter and not venting the area covered.

B. Frames

Frames shall be 16 gauge steel throughout and sized as detailed. Frames shall have 2" wide frame face and 5/8" stop, with 2" wide frame face at head where detailed. Jambs shall be constructed to set on finished floor. Rubber mutes shall be shipped attached to lock jambs. Frames shall be the width of the finished wall. Frames shall be drilled for door silencers.

Frames shall reach the site in good condition. All frames shall be packed with insulation during installation when erecting the metal building.

All frames shall be mortised and reinforced with heavy gauge reinforcing for hinges and lock strikes. Sill anchors shall be furnished for attaching frames to floor and jamb anchors for bonding frames to wall framing. Provide 6 jamb anchors and 2 sill anchors to meet wall conditions.

Frames shall be erected plumb, true and square and in accordance with the drawings. Experienced installers only shall be used. Provide temporary spreader on each frame.

Both sides of frames are to be caulked on top edge and sides for finished appearance.

8.2 Wood Doors And Frames

Wood doors shall be 1-3/4" solid core stain grade Birch or Mahogany Veneer in size indicated. Doors shall be delivered to the jobsite in protective wrap.

Products of the following manufacturers are acceptable, provided they comply with the remainder of this specification.

Weyerhaeuser
Algona Wood Doors
Eggers, Inc.
American Door Mfg.

Metal door frames are to be used (same as frames used for metal doors).

8.3 Special Doors

8.3.1 Sliding Metal Fire doors

Non-Applicable

8.3.2 Metal-Covered Doors

Non-Applicable

8.3.3 Coiling Doors

Non-Applicable

8.3.4 Plastic-Faced Doors

Non-Applicable

8.3.5 Folding Doors

Non-Applicable

8.3.6 Overhead Doors

All overhead doors and appurtenances specified herein shall be by one manufacturer. Overhead doors shall be Overhead Door company 591 Series Thermocore, or equal. Doors shall be sectional upward acting. Doors shall be equipped with a bolt type lock, installed on operator's side of door.Products of the following manufacturers are acceptable, provided they comply with the remainder of this specification.

Raynor
Wayne-Dalton Corp.
Clopay

Doors shall be accurately counterbalanced with torsion springs, tapered drums and galvanized lift cables. Operation shall be electric operator with back-up mechanical advantage chain lift.

Doors shall be equipped with ball bearing rollers. Doors shall be furnished with heavy duty double end hinges and long stem rollers. All hinges, bolts, bracing hardware, and horizontal bracing on each panel shall have the galvanized steel finish.

Sections shall be constructed for a 20' wide and 14' high opening all from galvanized corrosion resistant sheet steel with a rigid foamed-in-place polyurethane, CFC and HCFC free lamination process. Joints between the sections shall be designed and weather stripped to prevent air infiltration and water from dripping when the door is in open position. To provide extra strength, durability and resistance to damage, sections shall have .016 (26 gauge) exterior face metal and 0.16 inch interior

face metal thickness. A reinforcing strip of 1 inch shall extend full width at the top and bottom of each section to provide extra strength and a mounting base for all center hinges. Sections shall be fitted with 16 gauge galvanized end stiles.

Track shall be 3" Type, formed from .108 inch galvanized steel, lift clearance track. Provide heavy duty double end hinges, and heavy duty center hinges, all surface hardware shall be corrosion resistant galvanized steel. Rollers shall be 3" with steel roller bearing set in case-hardened races. Springs, Torsion Type, of proper size and type to be rated for 25,000 cycles. Panels to be thermal insulated with fire rating comparable to Class I (ASTM E-84-40) with flame spread of 15 and smoke density of 120. Must have a windload designed to meet or exceed industry standards for windloads (ANSI/NAGDM 102-1988) deflection. If door is in the horizontal position, deflection will not exceed 1/120 of the door width. Wind loading to meet 25 lbs. per sq. ft. Provide certified U value of .067 and installed R value of 5 based on certified test data. End styles shall be 16 gauge steel. Air infiltration shall not exceed .13 CFM per sq. ft. at 25 MPH.

Submittals are to include test results from an independent testing agency. Tests are to be performed in accordance with ASTM C236-87, NA GDM 105-1991, ASTM E238-84 and ASTM E330.

The electric door operator shall be a Model L side mounted unit with a ½ h.p. 208 volt, three phase, instant reversing, high torque, constant duty, and be equipped with rotary driver limit switches as an integral part of the mechanism to provide accurate setting to control up and down positions. The chain hoist shall be a standard integral mechanical drive unit designed to operate the door in case of power failure or failure of the electrical lifting system. During hand operations, limit switches shall remain timed to door position. The motor shall be protected against burn-out, overheat, and over-under current conditions. Doors are to be equipped with a sensing edge for automatic door stop on obstructions.

Operators shall be provided with the following:

a) Ball bearing power train. (Oil impregnated bronze bearings are not acceptable.)

b) Electrically and mechanically interlocked contactor.

c) Instant reversing motor.

d) Adjustable rotary type limit switches.

e) Solenoid Activated Drum type brake.

f) Adjustable disc friction clutch.

g) Emergency release kits/quick disconnect for manual or emergency operation.

Interior push button controls shall be standard low voltage circuit, 3-button, 3-position; open, close, stop, surface mounted station. Power source shall be from the electrical panel.

Exterior controls shall be 3BLM Exterior controls with best cylinders, surface mounted. Power source shall be from the electrical panel.

Standard vision panels of approximately 10" x 21" insulated windows shall be installed in the third section of the door at approximately eye level. Two panes of DS glass will be installed in two piece high impact polymer frames, and are to be constructed to prevent moisture entry and fogging.

Provide sealing strip on top section to seal door against the header when door is in closed position. Provide jamb seal on vertical edge of each jamb angle supporting the tracks to prevent contact between conductive metal surfaces sealing against wind, rain and heat loss. Provide seals fitted inside every between-section joint. Provide bulb type EPDM sealing weather strip full width of each bottom section to conform and seal to slightly irregular floor surface.

Sections shall be painted white with a two coat baked on polyester finish interior and exterior.

All doors shall be installed for the highest lift possible to gain interior overhead clearances

Door and all equipment shall be installed by the specialty overhead door trained personnel, and all work shall be accomplished in a professional manner to guarantee quality workmanship, material, and material functions. No damaged or used materials shall be used. Contractor shall guarantee workmanship and material for a period of one year after the acceptance, and shall provide service without charge to the owner during this period if cause of trouble is due to either faulty material or workmanship. After a 90-day period of performance

and operation under field conditions, the doors shall be serviced, checked and adjusted to the accepted standards by the overhead door trained personnel at no charge to the owner. Doors are to have a minimum 10 year delamination guarantee.

8.4 Windows

8.4.1 Steel Windows

Non-Applicable

8.4.2 Vinyl Windows

A. Horizontal Slides - Schedule A

Horizontal sliding windows of sizes shown shall be commercial quality as manufactured by Pacific Window Products, Inc. or approved equal.

All frame and sash materials shall be high quality impact-resistant extruded PVC vinyl. Component parts and accessories shall be of aluminum alloy, stainless steel, cadium plated steel, or non-metallic material which will neither deteriorate nor promote corrosion. Brass rollers shall be used in a nylon housing. Weather stripping shall be silicon-treated woven polypropylene pile with a polypropylene finseal. Screen panels shall be fabricated with .025 thick roll formed aluminum frames and screened with 18 x 16 mesh Avista weaves aluminum screen cloth.

All frame members shall be multi-chambered hollow wall construction with all primary walls having a .080 minimum thickness. All frame and sash extrusions shall have mitered construction and be heat fusion welded for maximum rigidity and to form a square, durable, weather and watertight assembly. Frames shall be built to accept 3/4" thick window units as specified. Frame color shall be Almond.

B. Fixed Window Units - Schedule B:

Non-applicable

8.5 Finish Hardware

The hardware supplier shall wrap and protect hardware for shipment and furnish and deliver to the building all items of finishing hardware hereinafter specified to complete the building.

The Contractor shall receive hardware when delivered at the site. The Contractor shall be responsible for correct application according to factory installation instructions, leaving hardware in proper working order by adjusting hardware and tightening all nuts, bolts, screws, etc., before completing the project.

The following abbreviations are used to indicate finish hardware manufacturers' brand names for the hardware schedule:

(T) TRIMCO
(H) HAGER Hinge
(Q) QUALITY Hardware
(C) CORBIN-RUSSWIN
(B) BEST Locks
(P) PEMKO
(G) Glynn-Johnson
(L) LCN
(Y) YALE

Approved Equals
Stanley
Builders Brass Works
Best
Corbin-Russwin
Trimco

All locks shall be Best, with Best Key Cylinders. This is a six pin system.

All locks shall be keyed as directed. (Keyed outside only with turn latch on interior.)

Best cores and keys for locks will be supplied by Owner. Red cores shall be used during construction.

8.5.1 Hardware Schedule

Door #1

All hardware shall be furnished by overhead door supplier.

Door #2 (3 each)

1-1/2 Pr (H) Hinges BB1279, 4-1/2" x 4-1/2" NRP 26 D
1 Ea (Y) Exit device lockset, 2100 x AU526F
1 Ea (B) Cylinder, 1E62 26 D
1 Ea (L) Closer 4041 Super Smoothie H.O. Arm, Aluminum Paint
1 Ea (P) Threshold, 271A x 36" Aluminum
1 Ea (P) Door Bottom Sweep, 210-A-36"
1 Set (P) Weather strip, 303-AS 3070
1 Ea (G) Door Stop, FB 18S or Trimco 1209
1 Ea (H) Kick Plate, 194 S 10" x 34" 630

Door #3 (5 each)

1-1/2 Pr (H) Hinges BB1279, 4-1/2” x 4-1/2” NRP 26 D
1 Ea (B) Lockset 73K 7D 15C 53 26 D
1 Ea (P) Threshold, 271A x 36" Aluminum
1 Ea (P) Door Bottom Sweep, 210-A-36"
1 Ea (IVES) Wall Mount Door Stop, 447 26D (office door only)

Door #4 (1 Pr each)

3 Pr (H) Hinges BB 1279, 4-1/2” x 4-1/2” NRP 26 D
1 Ea (B) Cylinder, 1E62 26 D
1 Ea (Y) Exit device lockset, 2100 x AU526F
1 Ea (L) Closer 4041 Super Smoothie H.O. Arm, Aluminum Paint
1 Set (IVES)Surface Mount Bolts 453 - 26 D
2 Ea (G) Door Stop, FB 18S or Trimco 1209
1 Set (P) Weather strip, 303-AS
2 Ea (P) Door Bottom Sweep, 210-A-36"

8.6 Glass & Glazing

This section shall encompass all glazing materials including glass, glaziers' paints, setting pads, glazing compounds and installation materials.

Glass shall be factory labeled on each pane or panel showing the make, type, strength, grade, thickness and quality. Labels shall remain intact on panels until approved. Labels shall be removed under the general clean-up provisions of the contract after approval.

All glass shall meet requirements of Federal Specification DD-G451a. Do not install glass with broken or chipped edges.

Obtain all glazing sizes from the work at the building site or from the manufacturer of frames, doors, or panels, into which the glazing units are to be set. Responsibility for glazing sizes shall be that of the Contractor.

Submit samples of glazing for approval as may be required. All glazing material expressly specified below and glazing material offered as approved equal for that specified shall be submitted for approval prior to procurement for this contract.

All exterior windows shall be insulated glazed. Window units shall have 3/4" thick insulating thermal glass. After fabrication, all window frame material shall be cleaned.

Sealant at head and sill of windows shall be provided as detailed on shop installation drawings.

All windows shall be installed in an acceptable workmanlike manner. All sealant lines shall be straight and even. Windows shall be plumb, true to horizontal and vertical lines. Clean all window frames and glass upon completion of installation procedures.

Interior passage doors where detailed on plans shall be glazed with 1/4" wire glass. Exterior insulated doors shall be glazed with 5/8" insulating wire glass.

Overhead doors shall be thermal glazed to manufacturer's requirements.

Glass types shall include the following:

1. 3/4" Thermal Insulated Window Glass
2. 5/8" Thermal Wire Glass

See plans for location of different types of glass and/or wall panels. Order glass in time to cause no delay in the work; however, see Engineer first to determine if there will be any changes in design or color. If colored glass is used, see Engineer for graining and specific installation instructions before ordering.

All glass shall be glazed with glazing compound in a manner to leave glass free of rattles and with waves running horizontally. Mirrors shall be set with chromium plated brass clips or other rust-proof devices, accurately anchored to wall. Secure fastenings to walls with concealed hinges of rust-proof metal. Mirrors are specified in Division 10.

8.6.1 Installation

All glass and glazing shall be installed in strict accordance with the manufacturer's installation recommendations, the specifications in the glazing manual as published by the Flat Glass Jobbers' Association, and the requirements of these specifications.

Sashes shall be square and true in plane prior to installation. Glass stop and frame clearances shall be 1/8" each edge. Do not cover windows with paint or paper.

All glass or glazing panels broken, chipped, spalled, scratched or damaged before acceptance of the building by Owner as being substantially completed shall be replaced by the Contractor at the expense of the Contractor, regardless of the time or cause of damage.

All glass and glazing shall be thoroughly cleaned after acceptance.

Cleaning shall be performed by the Glass and Glazing Subcontractor under the direction of the General Contractor, who will be held ultimately responsible for clean-up work of this section.

(NOTE: All exterior doors and windows are to be caulked, inside and out.)

9.1 Gypsum Drywall

The Contractor shall furnish all materials, labor, and scaffolding required to satisfactorily complete all drywall work shown on the drawings and/or specified.

9.1.1 Materials

Gypsum Wallboard shall be 5/8" fire rated or rated for moisture guard. Long edges shall be tapered.

Fasteners shall be recommended screws for wallboard installation.

Joint reinforcing tape shall be perforated. Joint compound shall be provided. All edges shall be taped.

Corner beads shall be 1-1/4" x 1-1/4" for 5/8" board. Casing beads and trim shall be galvanized steel. Where sheet rock comes in contact with brick, block or concrete, metal edges shall be installed.

Moisture Guard shall be 5/8" thick, apply to wall and ceiling surfaces in restrooms.

Walls shall have a light orange peel textured surface.

9.1.2 Installation

Examine and inspect materials to which gypsum board is to be applied. Remedy all defects prior to installation of dry-wall. Any defects in the finished installation due to misaligned framing or other cause shall be the responsibility of the work performed under that section of the specifications, and such defects shall be remedied under that section of the specifications.

A uniform room temperature above 50^{O}F shall be maintained during application and until completely dry or occupied. Provide adequate ventilation.

NOTE: Temperature minimum may be 40^{O}F when Quik-Treat Joint compound is used.

Gypsum wallboards shall be cut by scoring and breaking, or by sawing, working from the face side. Where board meets projecting surfaces it shall be scribed neatly.

Wallboard shall be applied first to ceiling, then to walls at right angles to framing members. Boards of maximum practical length shall be used so that they make an absolute contact with other, but shall not be forced into place. Wallboard joints at openings shall be located so that no end joint will align with edges of opening. End joints shall be staggered and joints on opposite sides of a partition shall not occur on the same stud.

1 1/4" type “S” sheet rock screws shall be used in a pattern as specified by 1997 UBC Table No. 25C and the Gypsum Association.

The boards shall be held in firm contact with the nailing member while the screws are being driven. Screws shall proceed from central portion of board towards ends and edges. The screws shall be driven home with the heads slightly below the surface of the board in a dimple formed by the driving tool. Care shall be taken to avoid breaking the paper face. Improperly driven screws shall be removed.

9.1.3 Joint and Corner Finishing

Joint compound shall be mixed in accordance with printed instructions contained in the package.

A uniformly thin layer of joint compound shall be applied over the joint approximately 4" wide. The tape shall be centered over the joint and embedded into the compound leaving sufficient joint compound under the tape to provide proper bond. Ceiling and wall angles and inside corner angles shall be reinforced with tape folded to conform to the angle and embedded into the compound.

After compound is thoroughly dry, the tape shall be covered with a coat of joint compound, approximately 3" on each side of the tape and feathered out at the edge. After thoroughly dry, another coat of joint compound shall be applied with slight, uniform crown over the joint. This coat shall be smooth and the edges feathered approximately 3" beyond the preceding coat.

All inside corners shall be coated with at least one coat of joint compound with the edges feathered out.

All nail or screw heads or dimples shall receive three coats of joint compound; this may be applied as each coat is applied to the joints, allowing 24 hours drying time between coats; 2-1/2 hours if Quik-Treat joint compound is used.

Flanges of wallboard corner bead shall be concealed with at least two coats of compound. The first coat shall be joint compound and the second coat may be joint compound or topping compound feathered out approximately 9" on both sides of the exposed metal nose.

Allow each application of compound to joints and nailheads to dry, then sand if necessary. Caution shall be used to avoid roughing of the wallboard paper. All wallboard and treated areas shall be smooth and ready for decoration.

All joints, fasteners, and irregularities shall be finished with Joint Treatment Products; and shall be clean and dry. All surfaces shall receive a texture finish as approved by the Engineer before the walls and ceilings are painted. All gypsum wallboard shall be sealed and painted.

9.2 Suspended Ceiling System

Non-Applicable

9.3 Wood Flooring

Non-Applicable

9.4 Resilient Flooring

Contractor shall provide a constant temperature of at least 70°F for 48 hours prior to installation, during installation, and 48 hours after installation. A minimum of 55° shall be maintained thereafter. All surfaces to receive resilient flooring finishes shall be dry, clean and smooth. Concrete sub-floor tolerances shall not be over 1/8" in ten feet in any direction. Conventional concrete curing methods shall be used; i.e., felt, paper, straw, plastic sheeting, water. Where curing compounds have been used, the concrete surface shall be prepared by sanding, sandblasting, or grinding. (Exception: Subcontractor can guarantee installation of vinyl tile over resin or asphalt-type curing and/or breaker compounds; i.e., other than wax or paraffin compound, with Armstrong S-90 cement). Subcontractor shall determine the acceptability of surface and construction for materials specified.

Subcontractor shall indicate adverse conditions of any type by letter to the General Contractor with a copy to the Engineer. Any work start shall indicate acceptance by the Subcontractor.

Before installation is initiated, properly identified samples shall be submitted by the Contractor and approved. Samples shall be marked with brand, size, gauge and color.

9.4.1 Material

Only first quality resilient flooring materials applied in strict accordance with the manufacturer's current specifications shall be furnished. Tile shall be used in the office area, but sheet covering shall be used in the toilet areas.

Adhesives and other application material shall be those as recommended specifically by the manufacturer of the material specified.

Flooring material shall be Armstrong Vinyl Tile, or equal, 12" x 12" size, 1/8" thick. Toilet room floor shall be covered with .090" gauge sheet material and shall extend upward onto the walls at least 5".

Base shall be 4" vinyl or rubber wall base 1/8" thick with formed inside and outside corners, plain color.

Wood base shall be used on gypsum drywall in any areas not receiving resilient flooring and rubber base.

9.4.2 Cleaning and Waxing

It shall be the responsibility of the Contractor to damp-mop and apply a light coat of floor polish immediately after installation of the floor, taking care not to flood the floor. Newly installed resilient floors should not be scrubbed or thoroughly cleaned until 4 to 5 days after installation, to allow adhesive to set properly.

The floor shall be protected with undyed, untreated building paper or traffic control as necessary. Immediately prior to final inspection (not less than 4 to 5 days after installation), clean and wax floors as follows:

Clean with Armstrong S-321 Spruce-Up, rinse, dry thoroughly, and apply one to two coats of Armstrong S-380 Super Durelle Floor Finish or S-360 Mirasheen Vinyl Floor Polish, or equal.

9.5 Special Floorings

Non-Applicable

9.6 Special Coatings

Non-Applicable

9.7 Painting

Each coat of paint shall be applied at proper consistency and brushed evenly, free of brush marks, sags, runs and no evidence of poor workmanship. Color between coats of paint shall differ. Color variations between coats of paint should be enough to distinguish color change, but not enough to impair hiding. Care shall be exercised to avoid lapping of paint on glass or hardware. Paint to be sharply cut to lines.

Paint applied shall be recommended by the chosen manufacturers for the application surface and in the number of coats and in the manner specified.

NOTE: All approved paints shall be top-of-the-line quality. Painting Contractor must furnish complete schedule as written in these specifications, prior to painting. Only one brand of paint shall be used, unless otherwise specified.

Protective covers or drop cloths shall be used to protect floors, fixtures and equipment.

The Painting Subcontractor shall take the necessary steps to protect his work and the work of other Contractors during the time his work is in progress and the Contractor shall be responsible for any and all damage to the work or property of other Contractors caused by his employees or by himself.

No exterior painting or interior finishing shall be done under conditions which jeopardize the quality or appearance of painting or finishing.

The Painting Subcontractor shall examine the drawings and specifications for painting work in other sections. He shall advise the Engineer of any conflict between his work and that of other trades, errors, omissions or impractical detail.

The Painting Contractor shall store all painting materials and equipment not in immediate use, in a room assigned for that purpose. Receiving and opening of all painting materials shall be done in this room.

All wood trim and cases installed as grounds shall be primed before being installed. Wood frames, trim and other woodwork installed against masonry, concrete or plaster shall be back primed.

Natural finish woodwork shall receive first seal coat before being installed. First coat of paint, stain or finish shall be applied as soon as possible after woodwork is fitted and erected. Shop coats of paint shall be touched up prior to application of priming called for under this Contract.

All surfaces shall be in proper condition to receive finish. Woodwork shall be hand sand-papered and dusted clean. All knotholes, pitchpockets or sappy portions shall be shellacked or sealed with knot sealer. Nail holes, cracks or defects shall be carefully puttied after first coat with putty matching color of stain or paint.

Interior woodwork finishes shall be sandpapered between coats.

Metals shall be clean, dry and free from mill scale and rust.

Remove all grease and oil from surface.

Unprimed galvanized metals shall be washed with a solution of chemical phosphoric metal etch and allowed to dry.

Concrete surfaces shall be wire brushed clean. Surfaces which are highly glazed, or where traces of parting compound are present, shall be sand-blasted or treated with diluted muriatic acid. The acid shall then be removed with water.

All colors will be selected by the Owner. The Painting Subcontractor shall submit for approval finished samples of the work to be specified. Work to match approved colors and samples. The number of exterior colors shall be limited to three total.

9.7.1 Materials

All paint and finish materials specified are Pratt & Lambert. Specified approved equals are Sherwin-Williams, Pittsburgh, Glidden, Bennett and Fuller.

NOTE: All paint, stains, etc., shall be the top of the line for each manufacturer.

Undercoat and systems shall be of the same manufacturer as the final coat. All materials

specified by brand name or brand manufacturer as the one selected for use under the above clause shall be delivered unopened at the job in their original containers. All containers are to be labeled.

No paint, varnish or stain shall be reduced or applied in any way whatever, except as herein specifically called for or recommended by the manufacturer.

Should conflict occur between specifications and manufacturers' recommendations and/or standard practice, notify the Engineer prior to work for clarification.

9.7.2 Exterior Painting Schedule

A. Miscellaneous Metal, Exposed Piping, Exposed Galvanized Metal Flashing, Door Guards, Sump Covers, Ventilators, and etc.
   1. One (1) coat P&L Effector Zinc Chromatic Primer
   2. Two (2) coats P&L Noxide Metal Paint

   NOTE: Remove oil and grease by solvent cleaning, and rust by sanding.

B. Bottom panel of Overhead Doors, Personnel Doors, and Frames
   1. Two (2) coats Alkyd Enamel

C. Wood, Trim and Molding
   1. One (1) coat P&L primer
   2. Two (2) coats sun proof house and trim paint (gloss)

9.7.3 Interior Painting Schedule

A. Miscellaneous Metals, Door Guards, Sump Covers, and etc.
   1. One (1) coat P&L Effector Zinc Chromate Primer
   2. Two (2) coats P&L Noxide Metal Paint

NOTE: Remove oil and grease by solvent cleaning and rust by sanding.

B. Drywall

   All exposed drywall shall be painted.
   1. One (1) coat P&L Vapex Wall Primer
   2. One (1) coat P&L Lyt-All Double Duty Primer w/tint
   3. One (1) coat P&L Lyt-All Flowing Semi-Gloss

   Restrooms
   1. One (1) coat wall primer-sealer
   2. Two (2) coats polyester epoxy

C. Doors (wood)
1. One (1) coat P&L Tonetic Wood Stain
2. One (1) coat P&L Sanding Sealer
3. Two (2) coats P&L Clear Finish Satin

(Doors shall be coated on all surfaces.)

D. Bottom Panel of Overhead Doors, Personnel Doors, and Frames
1. Two (2) coats Alkyd Enamel

E. Wood Trim, Plywood and Moldings
1. One (1) coat P&L Pro-Hide Primer
2. Undercoating
3. Two (2) coats P&L Pro-Hide Latex Satin Gloss

9.8 Wall Finishes

9.8.1 Wall Panel

Factory Finish On Metal Building. See Division 13.

9.8.2 Wall Covering

Non-Applicable

9.9 Special Finishes

9.9.1 Safety Painting

Safety painting shall be required as follows:

A. Bottom Panel of O.H. Doors, interior and exterior - O.S.H.A. Safety Yellow
B. O.H. Door Jambs - Safety Yellow - 8'0" High
C. O.H. Door Protector Posts (bollards) - Safety Yellow
D. Fire Extinguisher Wall Markings - Safety Red – 1’0” wide x 16’0” high
E Safety Equipment Wall Markings - Safety Green – 1’0” wide x 6’0” high
F. Clear zones for fire extinguishers, electrical panels and safety equipment. Clear zone areas to be painted on the floor will be black with a white border and placed as directed.

10.0 General

Submit complete shop drawings showing all details of all items specified in this division.

10.1 Toilet Partitions

Urinal Screen to be Bobrick Wall Hung Designer Series 1045, or approved equal Color will be selected by owner.

10.2 De-mountable Partitions

Non-Applicable

10.3 Disappearing Stairs

Non-Applicable

10.4 Fire Fighting Devices

Fire Extinguishers: (4 each) – Extinguishers by Owner
Shop Area - 3 each (one by each pass door)
Break Room – 1 each (one by N.E. corner)
(Location for safety painting for extinguishers per drawings.)

10.5 Toilet and Bath Accessories

Contractor shall furnish and install the following:

Robe Hook B-211.....1 RQD
Toilet Paper Holder B-288.....1 RQD
Soap Dispenser B-146.....1 RQD
18 x 30 Mirror & Shelf B-166.....1 RQD
Grab Bar B-6206 x 36 .....1 RQD
Paper Towel Dispenser B-263.....1 RQD

Bobrick catalog numbers are given for reference to quality desired.

11.0.1 Lubrication System General

The lubricating system shall be a new, latest, current model of manufacturer's standard construction and shall be Balcrank or approved equal. Though they are not specifically covered herein, all parts necessary to provide a complete and efficient system shall be furnished and shall include all accessories customarily furnished with a system of this type. Such parts shall conform to current engineering practices of the industry relative to design, strength, quality of material, and workmanship.

No demonstrators will be accepted.

Each unit shall be complete and installed with all equipment in place and ready for operation upon order completion.

Submit complete shop drawings showing all details of all items specified in this division.

The lubrication equipment furnished in these specifications will be used for servicing all types of construction equipment, pickups, and light to heavy-size trucks. Each unit shall meet or exceed the following minimum specifications.

11.1 Description

1. Type - Five unit air-operated overhead mounted system with lubricants being delivered through lines from central supply system.

2. Dispensing units shall include:

   a) Chassis Lube
   b) Engine Oil
   c) Hydraulic Oil
   d) Gear Oil
   e) Air

3. Requirement - Bidder shall furnish all information, part numbers and catalogs describing complete unit being furnished.

4. Warranty - One year parts and labor against defects and workmanship.

11.2 Lubrication Reels

1. Description - All reels shall be of quality design, spring retractable, and corrosion-resistant. Unit shall be designed to enable removing each reel individually without disturbing adjacent reels. Each reel will include high quality hose and ball retraction stop.

2. Chassis Lube Reel - Shall be a Balcrank model 821262 or approved equal including 30 feet of 1/4-inch 5,000 psi hose with a Balcrank model 1329-1 or approved equal control handle including swivel joint, pressure vent control, built-in booster, and 18-inch whip hose.
3. Engine Oil Reel - Shall be a Balcrank model 820415 or approved equal including 30 feet of ½-inch 800 psi hose with a Balcrank model 1483-4 or approved equal metered totalizing control handle (registering in quarts) including swivel, 10-inch flex hose, nondrip nozzle, and product type indicator plate.

4. Hydraulic Oil Reel - Shall be a Balcrank model 820415 or approved equal including 30 feet of ½-inch 800 psi hose with a Balcrank model 1486 or approved equal metered totalizing control handle (registering in gallons) including swivel, 10-inch flex hose, nondrip nozzle, and product type indicator plate.

5. Gear Oil Reel - Shall be a Balcrank model 820415 or approved equal including 30 feet of ½-inch 800 psi hose with a Balcrank model 1484-4 or approved equal metered totalizing control handle (registering in pints) including swivel, rigid non drip tip, and product type indicator plate.

6. Air Reel - Shall be a Balcrank model 821268 or approved equal with 40 feet of ½-inch 250 psi hose.

11.3 Pumps

1. Description - Shall be air-operated and include a Balcrank model 820260 or approved equal wall mounted air regulator with gauge, and a Graco model 215-362 or approved equal safety overrun valve for each pump. A Balcrank model 820281 or approved equal line filter and a Balcrank model 820282 or approved equal line lubricator shall be furnished in the main air service line.

2. Chassis Lube Pump - Shall be a Balcrank model 1064 or approved equal with a 45/50% ratio and a minimum of three pounds per minute rated capacity. It shall fit a 120-pound drum and include drum cover, pressure connection hose, a Balcrank model 4288 or approved equal follow plate, and all other items needed for complete installation.

3. Engine, Hydraulic, and Gear Oil Pumps - Shall be Balcrank model seven or approved equal with a minimum 4:1 ratio and a minimum three gallon per minute rated capacity. The pumps shall fit 55 gallon drums with bung adapters and include air expellers in the pump to prevent pumping or registering air through meter.

11.4 Piping

1. Description - High-pressure steel seamless tubing.

2. Size - 5/8-inch OD x .083-inch wall thickness on all lines.

3. Line Mounting - Lines shall be mounted uniformly to wall with unistrut supports at eight foot intervals.
Shut-Off Valves - Hand valve located in each line just ahead of reel.

11.5.1 General Waste Oil Tank

Waste oil tank supplied by ITD.

13.0 Steel Building & Components - Prefabricated Structure (SP-1 & 2) (Maintenance Building and Option1)

This specification covers the materials furnished for the metal building.

The materials furnished and installed shall include, but not be limited to the structural rigid framing, end wall columns, anchor bolts, rafter extensions, girts, purlins, window and door frames, canopy frames, wind bracing rods, eave struts, girt sag rods, purlin bridging, diaphragm bracing, stirrups, flange bracing, webb stiffeners, roofing, continuous ridge vent (with mechanical crank to shut ridge vent), crickets, siding, liner, interior and exterior trim, fasteners, bolts, sealants, caulking and any other component parts as needed for the metal building as specified.

The intent of these specifications and drawings is to establish a quality and performance level for structural design, material, durability and workmanship. All bidders must conform strictly to these specifications in their bid.

The building shall be of a manufacturer who is regularly engaged in the fabrication of pre-Engineered structures. All materials shall be new, unused, free from defects and of high quality manufacture.

All members fabricated or formed from hot rolled steel shall be hand cleaned to remove loose weld splatter, loose mill scale and loose rust and shall receive one shop coat of approved primer.

Products of the following manufacturers are acceptable provided that they comply with the remainder of this specification:

R & M Steel
Varco Pruden
B & C Building Systems
Wedgcor
HCI Building Systems

Steel Building Option: A building system meeting these specifications, comprised of folded web components as manufactured by Eagle Span Steel Structures may be substituted for the rigid steel frame construction.

The following standards and criteria (of most recent issue) shall be used where applicable in the structural design of the building covered by these specifications.

RECOMMENDED DESIGN PRACTICES MANUAL - Metal Building Manufacturers Assn
STEEL CONSTRUCTION MANUAL - American Institute of Steel Construction
COLD FORMED STEEL DESIGN MANUAL - American Iron and Steel Institute
CODE FOR WELDING IN BUILDING CONSTRUCTION - American Welding Society

The following criteria shall also be applicable in other phases of design:

Building code having jurisdiction over the area in which the site is located.

Structural Steel Painting Council Standards

Contractor shall furnish the Owner with a warranty for the roof that all work will be free from defects of materials or workmanship for a period of five (5) years from date of acceptance.

13.0.1 Building Description and Nomenclature

High Profile (HP) or straight column designates a clear span rigid frame building with a roof slope of 4:12 minimum for maintenance building, and aroof slope of 6:12 minimum for sand shed.

Structural mill shapes and built-up sections shall be designed in accordance with the latest edition of American Institute of Steel Construction (AISC), "Specification for the Design, Fabrication and Erection of Steel for Buildings."

Cold-formed steel members and exterior covering shall be designed in accordance with the latest edition of American Iron and Steel Institute (AISI), "Specification for the Design of Cold Formed Steel Structural Members."

13.1 Anchorage

The building anchor bolts shall be designed to resist the maximum column reactions resulting from the specific combinations of loadings. The anchor bolt sizes shall be specified by the building manufacturer unless otherwise noted. The column base plates shall be set level and with full bearing on the concrete foundations. Base channels shall be anchored with anchor bolts set on sill sealer material and pulled down evenly to form base seal.

13.2 Erection

The Contractor erecting the building shall be approved by the building manufacturer as an installer of their product, and have a minimum of three years experience in metal building construction.

The erection of the metal building and the installation of accessories shall be performed in accordance with building manufacturer's erection drawings using proper tools and equipment.

Erection practices shall, in addition, conform to Part IV, MBMA "Code of Standard Practices." There shall be no field modifications to primary structural members except as authorized and specified by the building manufacturer.

13.3 Design Loads

The basic design loads shall include live, wind, and earthquake, in addition to dead load. All of the design loads, whether they be a static, dynamic or kinetic nature, shall be considered as auxiliary loads. Live load design shall include 80 PSF ground snow load. Seismic zone 2B.

13.3.1 Vertical Loads

Roof covering shall be designed for 35 PSF uniformly distributed or a 300 pound concentrated (point) load (over 1' x 1' area) located at center of maximum roofing (panel) span, the most severe condition shall cover.

All of the above loads to be in addition to the applicable dead loads and shall be applied to the horizontal projection of the roof.

13.3.2 Wind Loads

The wind design of the structure shall be for 90 MPH velocity exposure B, as recommended by the Metal Building Manufacturers Association, Design Practice Manual of current issue.

13.3.3 Auxiliary Loads

Other superimposed dynamic and/or static loads shall be considered as part of the design requirements and combined with the normal design (live and/or wind) loads as prescribed hereafter.

Static Loads: Piping, heating units, light fixtures, ventilation equipment, etc.

13.3.4 Combination Loads

Combination of normal loads and auxiliary loads for design purposes shall be as prescribed and recommended by the Metal Building Manufacturers Association, Design Practice Manual of recent issue.

13.4 Drawings and Certification

The building manufacturer shall furnish complete erection drawings showing anchor-bolt settings, sidewalls, endwall and roof framing, transverse cross- sections, covering and trim details and accessory installation details to clearly indicate the proper assembly of all building parts. The manufacturer shall also furnish a letter of certification by a registered professional Engineer, verifying that the building design meets the specified loading requirements. After approval of these drawings by the Owner, the Contractor will coordinate with the Engineer and verify the existing plans meet the requirements set forth in the building plans for the building supplied.

If the building selected requires changes in the foundation plans, the Contractor shall furnish complete revised foundation plans for approval. The plans must bear the seal of a licensed architect or Engineer.

13.5 General Framing

All framing members shall be shop fabricated for bolted field assembly. Field cutting or drilling when required shall be clearly noted on the drawings. Field cutting or drilling will not be done with a cutting torch. Only approved drills or saws shall be used.

All shop connections shall be welded in accordance with the American Welding Society (AWS) "Standard Code for Welding in Building Construction." Certification of welder qualification will be furnished when required and specified.

All framing members shall carry an easily visible identifying mark, either stamped, stenciled or painted.

13.5.1 Primary Framing

Primary structural framing shall include transverse rigid frames, canopy beams, intermediate columns, and endwall columns.

Hot rolled structural mill shapes used in primary framing shall conform to the requirements of ASTM A 36. Hot rolled bars, plates, sheets or strip used in primary framing shall conform to the requirements of ASTM A 529, A 570, or A 572 with a minimum yield strength of 42,000 psi.

Rigid frames, tapered beams, lean-to and canopy beams and side columns shall be straight or tapered welded built-up I shapes or structural mill shapes.

Frame load bearing end walls per manufacturer’s recommendations for design load.

All base plates, splice plates, cap plates and stiffeners shall be factory welded in place and shall include bolt connection holes. Webs shall be shop fabricated to include brace rod holes and flange brace holes.

13.5.2 Secondary Framing

Secondary structural framing shall include the purlins, girts, eave struts, flange braces, sill support, rake angles, clips and other miscellaneous structural parts.

Hot rolled steel and strip used in fabrication of cold-framed members shall conform to the requirements of ASTM A 570 with a minimum yield of 55,000 psi.

The minimum size of the purlins and girts shall be 8" cold-formed "Z" sections with 2.5" flanges with stiffened edges. Stiffened flange edges shall be formed so as to permit nesting during shipping and when assembling overlapping continuous connections.

Eave struts shall be unequal flange "C" sections cold-formed so as to provide adequate back-up for both roof and wall panels at the building eave.

A continuous sill support member shall be provided to which the base of the wall covering shall be attached. This member shall be a galvanized channel anchored by anchor-bolts at 4'-0" on centers. Use 3/8" x 6" galvanized bolts.

Overhead door framing shall be designed to resist applicable wind loads and shall be a channel, cold-formed from 12 gauge hot dipped galvanized mill bonderized steel sheets. Frames shall receive one shop coat of base primer. Bolted connections shall be made with low profile round head bolts. Overhead door frames shall be for full height of the door opening.

13.6 Bracing

Wind bracing shall consist of diagonal rod, cable, or angle bracing in both roof and sidewalls. When diagonal bracing is not permitted in the sidewalls, a rigid frame type portal shall be placed between the frames. Sag rods or angles and bridging angles shall be placed properly along the center spans of all the girts and purlins.

The inside flanges of the rigid frames shall be braced laterally by angles connected diagonally to the webs of the girts and purlins.

13.7 Roof and Wall Covering

Exterior roof covering for the maintenance building shall be 24 gauge minimum thickness, galvanized, factory painted panels, standing seam with concealed clips. Exterior roof covering for the sand shed shall be 24 gauge minimum thickness galvanized factory painted steel ribbed panels. Exterior wall covering shall be 26 gauge minimum thickness, galvanized, factory painted, steel ribbed panels. Interior wall covering shall be 26 gauge minimum thickness, galvanized, factory painted, steel ribbed panels. Painted panel colors will be as approved by the Engineer.

Material for galvanized steel panels shall conform to the requirements of ASTM A 653 Grade 37 (37,000 PSI minimum yield) 1.15 ounce coating class.

Unless otherwise specified, the exposed exterior surface of all galvanized wall panels, flashing, trim, and other exterior galvanized steel surfaces shall be color coated (color to be selected by Owner) with silicone polyester coating system, which will meet or exceed the following durability criteria:

Film Integrity - Film will not peel, crack or blister, except for slight crazing on tightly formed bend lines as a result of accepted fabrication procedures for a period of 8 years on vertical ($\pm$ 15^{O}) surfaces or for a period of five years on nonvertical surfaces.

Chalk - Finish of vertical ($\pm$ 15^{O}) surfaces will not chalk in excess of a numerical rating of 8 for colors or 6 for white as measured by ASTM D 659 for a period of 8 years.

Color Change - Finish of vertical ($\pm$ 15^{O}) surfaces will not fade or change color more than 5 NBS units as measured by any standard Tristimulus colormeter in accordance with ASTM methods on a properly cleaned specimen for a period of 8 years.

The color (baked) finish for the wall panels shall be guaranteed by the building manufacturer for ten years against blistering, peeling, cracking, flaking, color change not to exceed 5NBS units per ASTM D 2244 and chalking shall be less than a rating of 8 per ASTM D 659.

13.8 Trim

Trim and flashing shall be furnished interior and exterior at the rake, corners, eaves, at all framed openings, and wherever necessary to provide weather tightness and finished appearance.

Galvanized steel for trim, flashings, rain gutters, downspouts and other miscellaneous uses shall be 26 gauge or heavier and shall be color coated. Ridge vents shall be provided complete with bird screen as required.

13.9 Bolts and Fasteners

All field connections shall be bolted. Structural bolts shall conform to ASTM A 325 with no washers and shall be tightened by the turn-of-the-nut method.

All panels shall be attached to secondary frame with #14 x 3/4" Type A self- tapping screws with cadmium plated carbon steel head and shank and domed washer with neoprene sealing element. Roof panels shall be jointed at side laps with the same fastener. Panels shall be properly fastened to every girt and purlin. The minimum spacing of the panel fasteners on the girt and purlin lines shall be 12" on centers. The minimum spacing of the side lap fasteners shall be 24" on centers, but properly designed and variable spaced to meet the snow and wind load requirements.

Optional fastener for wall panels shall be #14 x 1" self-drilling screw with cadmium plated carbon steel head and shank with domed washer and neoprene sealing element.

Trim laps shall be connected with 1/8" aluminum pop rivets.

Heads of all fasteners for colored panel and trim shall be pre-painted to match color of adjacent surface.

13.10 Sealant and Closures (Walls)

Sealant for sidelaps, endlaps, and flashings shall be a nominal 1/4" wide x 3/16" thick, gray pressure sensitive tape which shall be a blend of butyl rubber, plasticizers and inert fillers. The material shall be non-toxic, non-corrosive, non-shrinking and non-drying and shall have superior adhesion to metals, plastics and painted surfaces at temperatures from –40° to +180°F.

Clear silicone sealant shall be furnished for application at head and sides of windows, louvers, walk doors, framed openings, thresholds and where indicated on drawings.

Closed cell light gray EPCM closures matching the panel profile shall be installed along the eave, rake, soffit, bottom, and around all openings or accessories as required to provide a weathertight, airtight building.

13.11 Roof Sealants

The sealant shall be applied in the longitudinal and transverse joints of the roofing sheets to provide a waterproof seal that will not lose its sealing properties when exposed indefinitely to sunlight, moisture, and extreme temperature changes.

The compound shall be gray, pumpable grade, polybutens butyl rubber type, non-drying sealer. It shall exceed the performance requirements of the pressure sensitive tape type used for wall side laps.

The sealant shall have good cohesion and good adhesion to protective-coated steel. The material shall not be corrosive to the roof components. It shall pump satisfactorily from a loaded gun that has been stored at 10°F. for 12 hours; and shall not sag or slump at 120°F.

13.0 Fabric Covered Steel Tube Structure (SP-3) (Option 2)

This specification covers the materials furnished for the fabric covered steel double pipe truss shelter.

The materials furnished and installed shall include, but not be limited to the structural framing, anchor bolts, purlins, plate, bar stock, wind bracing rods/cables, purlin bridging, diaphragm bracing, fabric, fasteners, bolts and any other component parts as needed for the building as specified.

The intent of these specifications and drawings is to establish a quality and performance level for structural design, material, durability and workmanship. All bidders must conform strictly to these specifications in their bid.

The building shall be of a manufacturer who is regularly engaged in the fabrication of fabric covered steel frame buildings. All materials shall be new, unused, free from defects and of high quality manufacture.

Structure shall be a LBS Legend Cover-All Shelter System or approved equal

Products of the following manufacturers are acceptable provided that they comply with the remainder of this specification:

Cover-All Building Systems
Clear Span Inc (The Farley Group)
Rubb Building Systems
Hawkeye Steel Products Inc
HSS Structures
It is the responsibility of the contractor/manufacturer to provide full proof of product equality.

The following standards and criteria (of most recent issue) shall be used where applicable in the structural design of the building covered by these specifications.

The following criteria shall also be applicable in other phases of design:

Building code having jurisdiction over the area in which the site is located.

Contractor shall furnish the Owner with a warranty for the fabric and steel structure that it will be free from defects of materials or workmanship for a period of fifteen (15) years from date of acceptance.

13.1 Fabric

Fabric for cover shall meet or exceed the following specifications.

a. Material	16 X 16 woven KPDE scrim
b. Weight	12.5 oz/square yard
c. Thickness	23 mils
d. Coating	Modified LDPE coating with UV protection
e. Coating Thickness	4 mils, each side
f. Warranty	15 years pro rata

Color selection shall be from manufacturer's standard color selections.

Fabric drops will be provided to seal building roof to side of concrete walls.

13.2 Steel Tubing

Steel tubing for structure shall meet or exceed the following specifications.

a. Steel	Cold formed steel tubing with a yield strength of 55 KSI.
b. Welds	Finished with a molten zinc corrosion protection system
c. Rust Protection	Inside of tubing coated with a corrosion resistant coating. Exterior coated with hot dipped zinc galvanizing covered with a chromate conversion coating with a clear organic coating as the finish coat.
d. Warranty	15 year

Frame work for the building shall be capable of being mounted on pre-cast concrete blocks.

Aluminum tubing is not an accepted alternative material.

13.3 Anchorage

The building anchor bolts shall be designed to resist the maximum column reactions resulting from the specific combinations of loadings. The anchor bolt sizes shall be specified by the building manufacturer unless otherwise noted.

13.4 Erection

The Contractor erecting the building shall be approved by the building manufacturer as an installer of their product, and have a minimum of three years experience in fabric covered building construction. Welding shall be performed by a certified welder.

The erection of the fabric covered building and the installation of accessories shall be performed in
accordance with building manufacturer's erection drawings using proper tools and equipment. There shall be no field modifications to primary structural members except as authorized and specified by the building manufacturer.

13.5 Design Loads

The basic design loads shall include live, wind, and earthquake, in addition to dead load. All of the design loads, whether they be a static, dynamic or kinetic nature, shall be considered as auxiliary loads. Snow load design shall be 80 PSF ground snow load.

13.5.1 Wind Loads

The wind design of the structure shall be for 90 MPH velocity.

13.5.2 Combination Loads

Combination of normal loads and auxiliary loads for design purposes shall be as prescribed and recommended by the manufacturer.

13.6 Drawings and Certification

The building manufacturer shall furnish complete erection drawings showing anchor-bolt settings, sidewalls, endwall and roof framing, transverse cross- sections, covering and trim details and accessory installation details to clearly indicate the proper assembly of all building parts. The manufacturer shall also furnish a letter of certification by a professional civil engineer registered by the State of Idaho, verifying that the building design meets the specified loading requirements. After approval of these drawings by the Owner, the Contractor will coordinate with the Engineer and verify the existing plans meet the requirements set forth in the building plans for the building supplied.

If the building selected requires changes in the foundation plans, the Contractor shall furnish complete revised foundation plans for approval. The plans must bear the seal of a licensed civil engineer registered in the State of Idaho.

13.7 General Framing

All framing members shall be shop fabricated for bolted field assembly. Field cutting or drilling when required shall be clearly noted on the drawings. Field cutting or drilling will not be done with a cutting torch.

Only approved drills or saws shall be used.

All shop connections shall be welded in accordance with the American Welding Society (AWS) "Standard Code for Welding in Building Construction." Certification of welder qualification will be furnished when required and specified.

13.7.1 Bracing

Wind bracing shall consist of diagonal rod, cable, or angle bracing as recommended by the manufacturer.

13.8 Bolts and Fasteners

All field connections shall be bolted. Structural bolts shall conform to ASTM A 325 and shall be tightened by the turn-of-the-nut method.

13.9 Shop Drawings

Five (5) copies of all shop drawings shall be submitted for approval. Approved or noted drawings will be returned to the Contractor within fifteen (15) days.

Shop drawings so prepared and approved are deemed to represent the correct interpretation of the work to be done. Contractor shall furnish all necessary templates and patterns required by other trades and supervise and be responsible for proper location and installation.

13.10 O&M Manuals

On Project completion Contractor will supply 3 sets of O&M manuals to include fabric structure information and care, electrical products and all warranties.

14.0 Bridge Crane

This work shall include furnishing and installing a hand operated bridge crane as shown on the plans. The crane shall be 4000 lb. capacity, with ceiling clearances as indicated.

Electric chain hoist shall be a 2 ton model R product code 4234-208 volt, three phase, 1 HP, low headroom trolley model R product code 3569, with load limit. Hook Suspension model R product code 3668 with a metal chain container model R product code 2455 as manufactured by CM Lodestar or approved equal. Hoist shall have a minimum clear lift of 11 feet 6 inches from floor level. Hoist shall have friction clutch, dual braking system – heavy duty magnetic and regenerative.

The crane beam shall be a 15" S-42.9 continuous straight, selected member. Crane beam shackles shall be bolted on the crane beam per supplier's recommendations. Bolted trolley stops will be installed at each end of the crane beam on both sides.

Structural steel parts of the crane assembly shall be given one shop coat of red lead or zinc chromate paint after assembly and finishing, and one coat of gray machine enamel after erecting the building.

The bridge crane and all its parts shall be guaranteed free from all defects in labor, materials and operation for a period of one year from the date of acceptance.

Complete shop drawings shall be submitted for approval before fabrication is started. Field dimensions shall be verified by the fabricator.

IDAHO DEPARTMENT OF TRANSPORTATION
COUNCIL, IDAHO

Mechanical Specification Index

SECTION 15010 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1_ RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 15.

1.2 SUMMARY

A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:

1. Submittals.
2. Record documents.
3. Maintenance manuals.
4. Rough-ins.
5. Mechanical installations.
6. Cutting and patching.

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 15 Section "BASIC MECHANICAL MATERIALS AND METHODS" for materials and methods common to the remainder of Division 15 plus general related specifications including:
   a. Access to mechanical installations.
   b. Excavation for mechanical installations within the building boundaries and from building to utilities connections.

1.3 SUBMITTALS

A. General: Follow the procedures specified in Division 1 Section "SUBMITTALS."

B. Substitutions and Material Submittals: By specific designation and description, standards are established for specialties and equipment.

C. Other makes of specialties and equipment of equal quality will be considered, provided such proposed substitutions are submitted to the Architect for his approval at least ten (10) calendar days prior to bid opening. A schedule showing make, type, manufacturer's name and trade designation of all materials and equipment proposed as a substitution shall be submitted together with a single copy of the manufacturer's complete specifications. A list of approved substitutions will be published as an addendum.

D. Within thirty (30) days after award of contract, this Contractor shall submit in six copies a schedule showing make, type, manufacturer's name and trade designation of all materials and equipment he proposes to use and furnish. This schedule shall be accompanied by the manufacturer's complete specification, in six copies, for each equipment item or materials used, give complete information as to capacities, ratings, kind of material used, finish guarantee, etc., and such dimensions as are necessary to check space requirements. When approved, such schedule and drawing shall be in addition to these specifications and shall be

in equal force in that no variation shall be permitted. The Architect is to be the sole judge as to the quality of any material offered as an equal. See General Conditions and Supplementary Conditions.

E. Design is based on equipment as listed in the equipment schedule. All changes in foundations, bases, connections, piping, controls, starters, electrical equipment, wiring and conduit, space, openings, walls and ceilings and sound and vibration isolation required by alternate equipment specified, submitted and approved shall be made at no additional cost to the Owner.

F. Approval rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are approved, said approval does not mean that drawings have been checked in detail; said approval does not in any way relieve the subcontractor from his responsibility or necessity of furnishing material or performing work as required by the contract drawings and specifications.

G. Increase, by the quantity listed below, the number of mechanical related shop drawings, product data and samples submitted to allow for required distribution plus two copies of each submittal required, which will be retained by the Mechanical Consulting Engineer.

1. Shop Drawings - Initial Submittal: 1 additional blue- or black-line prints.
2. Shop Drawings - Final Submittal: 1 additional blue- or black-line prints.
3. Product Data: 1 additional copy of each item.

H. Additional copies may be required by individual sections of these Specifications.

1.4 RECORD DRAWINGS

A. Prepare record documents in accordance with the requirements in Division 1. In addition to the requirements specified in Division 1, indicate the following installed conditions:

1. Mains and branches of piping systems with valves and control devices located and numbered, concealed unions located and with items requiring maintenance located (i.e., traps, strainers, etc.). Indicate actual inverts and horizontal locations of underground piping.
2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
3. Approved substitutions, Contract Modifications and actual equipment and materials installed.
4. Contract Modifications, actual equipment and materials installed.

1.5 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 1. In addition to the requirements specified in Division 1, include the following information for equipment item:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in and routine and normal operating instructions, regulation, control, stopping, shutdown and emergency instructions and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting, disassembly, repair and reassembly, aligning and adjusting instructions.

4. Servicing instructions and lubrication charts and schedules.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels and other information needed for identification.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 FEES AND PERMITS

A. Arrange and pay for any fees, connection charges, hook-up fees, etc., required with local governing bodies, utilities, etc.

3.2 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

3.3 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate and integrate the various elements of mechanical systems, materials and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots and openings in other building components during progress of construction to allow for mechanical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components as they are constructed.
5. Sequence, coordinate and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials and equipment to provide the maximum headroom possible.
7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies and controlling agencies. Provide required connection for each service.
8. Install systems, materials and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
9. Install systems, materials and equipment level and plumb, parallel and perpendicular to

other building systems and components where installed exposed in finished spaces.

10. Install mechanical equipment to facilitate servicing, maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting with minimum of interference with other installations. Extend grease fittings to an accessible location.
    a. NOTE: All mechanical items, equipment, etc., requiring access and maintenance to be provided with access panels by mechanical contractor when located behind hard inaccessible finished surfaces.
11. Install access panel or doors where units are concealed behind finished surfaces.
12. Install systems, materials and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.4 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 1 Section "CUTTING AND PATCHING." In addition to the requirements specified in Division 1, the following requirements apply:

1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

A. Perform cutting, fitting and patching of mechanical equipment and materials required to:

1. Uncover work to provide for installation of ill-timed work.
2. Remove and replace defective work.
3. Remove and replace work not conforming to requirements of the Contract Documents.
4. Upon written instructions from the Architect, uncover and restore work to provide for Architect/Engineer observation of concealed work.

B. Protect the structure, furnishings, finishes and adjacent materials not indicated or scheduled to be removed.

C. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

1. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION 15010

SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Sleeves.
5. Grout.
6. Equipment installation requirements common to equipment sections.
7. Painting and finishing.
8. Concrete bases.
9. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces and tunnels.

B. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Escutcheons.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage and handling to prevent pipe end damage and to prevent entrance of dirt, debris and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots and openings in building structure during progress of construction to allow for mechanical installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Mechanical Contractor to provide access panels in finished surfaces as required to access mechanical equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the manufacturers specified.

2.2 PIPE, TUBE AND FITTINGS

A. Refer to individual Division 15 piping Sections for pipe, tube and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 15 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8" maximum thickness unless thickness or specific material is indicated.
   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
2. AWWA C110, rubber, flat face, 1/8" thick, unless otherwise indicated, and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic Pipe-Flange Gasket, Bolts and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated, and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert and one solvent-cement-joint end.

1. Available Manufacturers:
   a. Eslon Thermoplastics.

B. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring and union nut.

1. Available Manufacturers:
   a. NIBCO INC.

b. NIBCO, Inc.; Chemtrol Div.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250 psig minimum working pressure at 180° F.

1. Available Manufacturers:
   a. Capitol Manufacturing Co.
   b. Central Plastics Company.
   c. Eclipse, Inc.
   d. Epco Sales, Inc.
   e. Hart Industries, International, Inc.
   f. Watts Industries, Inc.; Water Products Div.
   g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, threaded ends and 300 psig minimum working pressure at 225° F. ASTM F492PP.

1. Available Manufacturers:
   a. Calpico, Inc.
   b. Lochinvar Corp.

E. Dielectric Nipples: Electroplated-steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded or grooved ends and 300 psig minimum working pressure at 225° F. ASTM F492PP.

1. Available Manufacturers:
   a. Perfection Corp.
   b. Precision Plumbing Products, Inc.
   c. Sioux Chief Manufacturing Co., Inc.
   d. Victaulic Co. of America.

2.6 SLEEVES

A. Galvanized-Steel Sheet: 0.0239" minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Molded PVC: Permanent with nailing flange for attaching to wooden forms.

E. PVC Pipe: ASTM D 1785, Schedule 40.

F. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.7 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous and recommended for interior and exterior applications.
2. Design Mix: 5000 psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.

B. Drawing plans, schematics and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Sleeves are not required for core-drilled holes.

M. Permanent sleeves are not required for holes formed by removable PE sleeves.

N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.
   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2" above finished floor level. Extend cast-iron sleeve fittings

below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4" annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
   a. PVC or Steel Pipe Sleeves: For pipes smaller than NPS 6.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth and location of joint.

O. Verify final equipment locations for roughing-in.

P. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions in piping NPS 2 and smaller adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges in piping NPS 2-1/2 and larger adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of

dissimilar metals.

4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at project.

1. Construct concrete bases of dimensions indicated, but not less than 4" larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18" centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000 psi, 28-day compressive-strength concrete and reinforcement.0

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit and place miscellaneous metal supports accurately in location, alignment and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1.

3.8 GROUTING

A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment baseplates and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 15050

SECTION 15060 - HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes hangers and supports for mechanical system piping and equipment and seismic bracing and supports for Zone 2B, SHL B.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents and test water.

B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents and test water.

C. Design seismic restraint hangers and supports for piping and equipment. This project is located in Seismic Zone 2B, SHL B.

D. Design and obtain approval from authorities having jurisdiction for seismic restraint hangers and supports for piping and equipment.

1.5 SUBMITTALS

A. Product Data: For each type of pipe hanger, channel support system component and thermal-hanger shield insert indicated.

1.6 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Pipe Hangers:
    a. AAA Technology and Specialties Co., Inc.
    b. B-Line Systems, Inc.
    c. Carpenter & Patterson, Inc.
    d. Empire Tool & Manufacturing Co., Inc.
    e. Globe Pipe Hanger Products, Inc.
    f. Grinnell Corp.
    g. GS Metals Corp.
    h. Michigan Hanger Co., Inc.
    i. National Pipe Hanger Corp.
    j. PHD Manufacturing, Inc.
    k. PHS Industries, Inc.
    l. Piping Technology & Products, Inc.

2. Channel Support Systems:
    a. B-Line Systems, Inc.
    b. Grinnell Corp.; Power-Strut Unit.
    c. GS Metals Corp.
    d. Michigan Hanger Co., Inc.; O-Strut Div.
    e. National Pipe Hanger Corp.
    f. Thomas & Betts Corp.
    g. Unistrut Corp.
    h. Wesanco, Inc.

3. Powder-Actuated Fastener Systems:
    a. Gunnebo Fastening Corp.
    b. Hilti, Inc.
    c. ITW Ramset/Red Head.
    d. Masterset Fastening Systems, Inc.

2.2 MANUFACTURED UNITS

A. Pipe Hangers, Supports and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.

1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

2.3 MISCELLANEOUS MATERIALS

A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Structural Steel: ASTM A 36/A 36M, steel plates, shapes and bars, black and galvanized.

D. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.

1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Nonstaining, noncorrosive and nongaseous.
3. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger requirements are specified in Sections specifying equipment and systems.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of insulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120^{o} to 450^{o} F pipes, NPS 4 to NPS 16, requiring up to 4" of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4" of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of insulated stationary pipes, NPS 3/4 to NPS 8.
7. Adjustable Steel Band Hangers (MSS Type 7): For suspension of insulated stationary pipes, NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of insulated stationary pipes, NPS 1/2 to NPS 8.
9. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of insulated stationary pipes, NPS 1/2 to NPS 2.
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of insulated stationary pipes, NPS 3/8 to NPS 8.

D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system

Specification Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6" for heavy loads.
2. Steel Clevises (MSS Type 14): For 120° to 450°F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120° to 450° F piping installations.

F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels or angles.
3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
5. C-Clamps (MSS Type 23): For structural shapes.
6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
8. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
9. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
   a. Light (MSS Type 31): 750 lb.
   b. Medium (MSS Type 32): 1500 lb.
   c. Heavy (MSS Type 33): 3000 lb.
10. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

G. Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.

3.2 HANGER AND SUPPORT INSTALLATION

A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps and attachments as required to properly support piping from building structure.

B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.

1. Field assemble and install according to manufacturer's written instructions.

C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual

pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

D. Install building attachments and attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints and at changes in direction of piping.

E. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.

F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.

G. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

H. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

I. Insulated Piping: Comply with the following:

1. Install MSS SP-58, Type 40 protective shields on piping with vapor barrier. Shields shall span arc of 180 degrees.
2. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2: 12" long and 0.048" thick.
3. Insert Material: Length at least as long as protective shield.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.4 METAL FABRICATION

A. Cut, drill and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 15060

SECTION 15772 - RADIANT HEATING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes radiant heating piping including pipes, fittings and piping specialties.

B. Related Sections include the following:

1. Division 15 Section "Basic Mechanical Materials and Methods" for general piping materials and installation requirements.
2. Division 15 Section "Hangers and Supports" for pipe supports, product descriptions and installation requirements.
3. Division 15 Section "Valves" for general-duty gate, globe, ball and check valves.
4. Division 15 Section "Hydronic Piping" for pipes and connections to hydronic systems.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. PE: Polyethylene.

C. PEX: Crosslinked polyethylene.

1.4 SUBMITTALS

A. Product Data: Radiant heating piping specialties including rated capacities and water flow and pressure drops of selected models.

B. Shop Drawings: Show piping layout and details drawn to scale including valves, manifolds, controls and support assemblies and their attachments to the building structure.

C. Maintenance Data: For manifolds and control devices to include in maintenance manuals specified in Division 1.

1.5 COORDINATION

A. Coordinate layout and installation of radiant heating piping system with building and structural components.

B. Coordinate size and location of access panels to allow access to manifolds concealed in floors.

C. Coordinate thickening of slabs where required for adequate encasement of radiant heating piping components.

D. Revise locations and elevations from those indicated as required to suit field conditions and ensure integrity of piping and as approved by Architect.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Distribution Manifolds:
   a. Heatlink USA Inc.
   b. Heatway, Inc.
   c. Hume Snow Melting Systems, Inc.
   d. Infloor Heating Systems.
   e. Rehau Inc.
   f. Tekmar Control Systems, Ltd.
   g. Vanguard Plastics, Inc.
   h. Wirsbo Co.

2. Mixing Valves:
   a. Heatlink USA Inc.
   b. Infloor Heating Systems.
   c. Rehau Inc.
   d. Wirsbo Co.

3. Controls:
   a. Heatlink USA Inc. (Heat timer).
   b. Hume Snow Melting Systems, Inc.
   c. Infloor Heating Systems.
   d. Tekmar Control Systems, Ltd.
   e. Wirsbo Co.

4. Thermostats:
   a. Heatlink USA Inc.
   b. Infloor Heating Systems.
   c. Rehau Inc.
   d. Tekmar Control Systems, Ltd.
   e. Wirsbo Co.

2.2 HEAT-TRANSFER PIPES AND FITTINGS

A. PE Plastic: ASTM D 2239, SIDR-11.5 for service at 30 psig and 140° F.

1. Fittings: ASTM F 1807, copper with stainless steel clamps.

B. PEX Plastic: ASTM F 876.

1. Fittings: ASTM F 1807, copper or brass compression type.

2.3 PIPING SPECIALTIES

A. Radiant-Pipe Mounting Tracks: Aluminum with pipe supports permitting pipe spacing as shown on the drawings.

2.4 RADIANT HEATING SPECIALTIES

A. Distribution Manifolds: Brass or copper modular design with mixing valve, main shutoff and balancing valves with thermometers, zone shutoff and balancing valves with flow meter and identification plate.

1. Mixing Valves: 125 psig, 230° F maximum operating pressure and temperature, brass or cast-bronze body, EPDM seals and threaded connections.
2. Identification Plate: Valve plate shall identify room served and loop number.
3. If more than one loop serves a room, provide identification plates on manifolds to identify rooms served.

2.5 CONTROLS

A. Provide electronic boiler/pump controllers similar to heat timer HWE Elite Series controller. Unit shall monitor outdoor air and reset boiler temperature as required to satisfy space temperature.

2.6 SEQUENCE OF OPERATION

A. On a call for heat from space T-stat, the system circulator shall be started and boiler enabled. System water temperature will be reset as required to maintain floor temperature. At 0° F outside-air temperature, water temperature to be 120° F (adjustable). At 60° F outside-air temperature, water temperature to be 80° F (adjustable).

B. The boiler shall fire on its internal controls.

C. Provide controller, outside-air sensor, system water temperature, sensor, pump control, boiler control and space T-stat.

PART 3 - EXECUTION

3.1 HEAT-TRANSFER PIPING INSTALLATION

A. Install piping downstream from manifolds without joints.

B. Secure piping in concrete floors by attaching pipes to concrete reinforcement using plastic tie straps.

1. Install a sleeve of foam-type insulation around tubing and extending for a minimum of 3" on each side of the slab penetration to protect the tubing passing through expansion joints.

C. Install manifolds in accessible locations.

D. Fill system with 40 percent of propylene glycol-to-water solution.

3.2 FIELD QUALITY CONTROL

A. Prepare radiant heating piping for testing as follows:

1. Temporarily restrain expansion joints so they are not damaged due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
2. Flush with clean water and clean strainers.
3. Install relief valve set at a pressure no more than one-third higher than test pressure.

B. Perform the following tests:

1. Subject piping to hydrostatic test pressure that is not less than 1.5 times the design pressure but not more than 100 psig.
2. After hydrostatic test pressure has been applied, examine piping, joints and connections for leakage. Eliminate leaks by tightening, repairing or replacing components and repeat hydrostatic test until there are no leaks.
3. Prepare a written report of testing.

3.3 ADJUSTING

A. After system balancing has been done, mark balancing (zone) valves to permanently indicate final position.

B. Perform the following adjustments before operating the system:

1. Open valves to fully open position. Close bypass valves.
2. Check operation of automatic valves.
3. Set temperature controls so all zones call for full flow.

3.4 CLEANING

A. After testing has been successfully completed, flush piping and clean strainer screens.

END OF SECTION 15772

SECTION 15083 - PIPE INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes preformed, rigid and flexible pipe insulation, insulating cements, field-applied jackets, accessories and attachments and sealing compounds.

B. Related Sections include the following:

1. Division 15 Section "Hangers and Supports" for pipe insulation shields and protection saddles.

1.3 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness and jackets (both factory and field applied, if any) for each type of product indicated.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting and certifying test results for compliance of insulation materials, sealers, attachments, cements and jackets with requirements indicated. Include dates of tests.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less and smoke-developed rating of 50 or less.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers and insulation shields specified in Division 15 Section "Hangers and Supports."

B. Coordinate clearance requirements with piping installer for insulation application.

1.7 SCHEDULING

A. Schedule insulation application after testing piping systems. Insulation application may begin on segments of piping that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Mineral-Fiber Insulation:
   a. CertainTeed Manson.
   b. Knauf FiberGlass GmbH.
   c. Owens-Corning Fiberglas Corp.
   d. Schuller International, Inc.

2.2 INSULATION MATERIALS

A. Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:

1. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.

2.3 FIELD-APPLIED JACKETS

A. General: ASTM C 921, Type 1, unless otherwise indicated.

B. Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil- thick, high-impact, ultraviolet-resistant PVC. Must be Class I for installation in plenum space.

1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints and P-trap and supply covers for lavatories for the disabled.
2. Adhesive: As recommended by insulation material manufacturer.

C. Aluminum Jacket: Factory cut and rolled to indicated sizes. Comply with ASTM B 209, 3003 alloy, H-14 temper.

D. Aluminum Jacket: Aluminum roll stock, ready for shop or field cutting and forming to indicated sizes. Comply with ASTM B 209, 3003 alloy, H-14 temper.

1. Finish and Thickness: Smooth finish, 0.010" thick.

2.4 ACCESSORIES AND ATTACHMENTS

A. Bands: 3/4" wide, in one of the following materials compatible with jacket:

1. Aluminum: 0.007" thick.

B. Wire: 0.080" nickel-copper alloy, 0.062" soft-annealed stainless steel or 0.062" soft-annealed galvanized steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories and finishes according to the manufacturer's written instructions with smooth, straight and even surfaces, free of voids throughout the length of piping including fittings, valves and specialties.

B. Refer to schedules at the end of this Section for materials, forms, jackets and thicknesses required for each piping system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften or otherwise attack insulation or jacket in either wet or dry state.

D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

E. Apply multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips or other attachment devices to piping, fittings and specialties.

G. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

H. Keep insulation materials dry during application and finishing.

I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

J. Apply insulation with the least number of joints practical.

K. Apply insulation over fittings, valves and specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves and specialties.

L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors and other projections with vapor-retarder mastic.

1. Apply insulation continuously through hangers and around anchor attachments.
2. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.

3. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support and shield.

M. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

N. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Circumferential Joints: Cover with 3" wide strips of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4" o.c.
3. Longitudinal Seams: Overlap jacket seams at least 1-1/2". Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4" o.c.
   a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.

O. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

3.4 MINERAL-FIBER INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of preformed pipe insulation to pipe with wire, tape or bands without deforming insulation materials.
2. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6" o.c.
3. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1" and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation or glass-fiber blanket insulation to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape or bands.
3. Cover fittings with standard PVC fitting covers.

D. Apply insulation to valves and specialties as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.

2. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.
3. Apply insulation to flanges as specified for flange insulation application.
4. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

3.5 FIELD-APPLIED JACKET APPLICATION

A. Apply PVC fitting covers where indicated with 1" overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

B. Apply metal jacket where indicated with 2" overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12" o.c. and at end joints.

3.6 PIPING SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials and equipment:

1. Flexible connectors.
2. Vibration-control devices.
3. Drainage piping located in crawl spaces, unless otherwise indicated.
4. Below-grade piping, unless otherwise indicated.
5. Chrome-plated pipes and fittings, unless potential for personnel injury.
6. Air chambers, unions, strainers, check valves, plug valves and flow regulators.

3.7 INSULATION APPLICATION SCHEDULE, GENERAL

A. Refer to insulation application schedules for required insulation materials and field-applied jackets.

B. Application schedules identify piping system and indicate pipe size ranges and material, thickness and jacket requirements.

3.8 INTERIOR INSULATION APPLICATION SCHEDULE

A. Service: Domestic cold, hot, recirculated hot water and hydronic piping.

1. Operating Temperature: 60^{o} F to 180^{o} F.
2. Insulation Material: Mineral fiber.
3. Insulation Thickness: Apply the following insulation thicknesses:
   a. Copper Pipe, 1/2" to 4": 1".
4. Field-Applied Jacket: PVC fitting covers.
5. Vapor Retarder Required: No.
6. Finish: None.
7. Install aluminum jackets on all piping within 8" of finished floor.

END OF SECTION 15083

SECTION 15100 - VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes general duty valves common to several mechanical piping systems.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Special purpose valves are specified in Division 15 piping system Sections.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each valve type. Include body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances and installation instructions. Include list indicating valve and its application.

C. Maintenance data for valves to include in the operation and maintenance manual specified in Division 1. Include detailed manufacturer's instructions on adjusting, servicing, disassembling and repairing.

1.4 QUALITY ASSURANCE

A. Single-Source Responsibility: Comply with the requirements specified in Division 1 Section "Materials and Equipment" under "Source Limitations" paragraph.

B. ASME Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.

C. MSS Compliance: Comply with the various MSS Standard Practice documents referenced.

1.5 DELIVERY, STORAGE AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves and weld ends.
3. Set globe and gate valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store indoors and maintain valve temperature higher than ambient dewpoint temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

1. Gate Valves:
   a. Crane Company; Valves and Fitting Division.
   b. Hammond Valve Corporation.
   d. Kitz Corp. of America.
   d. Lunkenheimer/Cincinnati Valve Co.
   e. Milwaukee Valve Company, Inc.
   f. NIBCO Inc.
   g. Powell: Wm. Powell Company (The).
   h. Red-White Valve Corp.
   i. Stockham Valves & Fittings, Inc.

2. Ball Valves:
   a. Conbraco Industries, Inc.; Apollo Division.
   b. Hammond Valve Corporation.
   c. Milwaukee Valve Company, Inc.
   d. NIBCO Inc.
   e. Stockham Valves & Fittings, Inc.
   f. Tyler Pipe.
   g. Victaulic Company of America.

3. Plug Valves:
   a. Grinnell Corp.
   b. Huber: J.M. Huber Corp.; Flow Control Division (Resun Valves).
   c. NIBCO Inc.
   d. Stockham Valves & Fittings, Inc.
   e. Victaulic Company of America.

4. Globe Valves:
   a. Crane Company; Valves and Fitting Division.
   b. Hammond Valve Corporation.
   c. Kitz Corp. of America.
   d. Lunkenheimer/Cincinnati Valve Co.
   e. Milwaukee Valve Company, Inc.
   f. NIBCO Inc.
   g. Powell: Wm. Powell Company (The).
   h. Red-White Valve Corp.
   i. Stockham Valves & Fittings, Inc.

5. Swing Check Valves:
   a. Cla-Val Co.
   b. Crane Company; Valves and Fitting Division.
   c. Hammond Valve Corporation.

d. Kitz Corp. of America.
e. Lunkenheimer/Cincinnati Valve Co.
f. Milwaukee Valve Company, Inc.
g. NIBCO Inc.
h. Powell: Wm. Powell Company (The).
i. Red-White Valve Corp.
j. Stockham Valves & Fittings, Inc.
k. Victaulic Company of America.

2.2 BASIC, COMMON FEATURES:

A. Design: Rising stem or rising outside screw and yoke stems, except as specified below.

1. Nonrising stem valves may be used only where headroom prevents full extension of rising stems.

B. Pressure and Temperature Ratings: As indicated in the "Application Schedule" of Part 3 of this Section and as required to suit system pressures and temperatures.

C. Sizes: Same size as upstream pipe unless otherwise indicated.

D. Operators: Use specified operators and handwheels, except provide the following special operator features:

1. Handwheels: For valves other than quarter turn.
2. Lever Handles: For quarter-turn valves 6" and smaller, except for plug valves which shall have square heads. Furnish Owner with 1 wrench for every 10 plug valves.

E. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.

F. Bypass and Drain Connections: Comply with MSS SP-45 bypass and drain connections.

G. Threads: ASME B1.20.1.

H. Flanges: ASME B16.1 for cast-iron, ASME B16.5 for steel and ASME B16.24 for bronze valves.

I. Solder Joint: ASME B16.18.

1. Caution: Where soldered end connections are used, use solder having a melting point below 840^{o} F for gate, globe and check valves; below 421^{o} F for ball valves.

2.3 GATE VALVES

A. Gate Valves, 2-1/2" and Smaller: MSS SP-80, Class 125, 200 psi cold working pressure (CWP) or Class 150, 300 psi CWP; ASTM B 62 cast-bronze body and bonnet, solid-bronze wedge, copper-silicon alloy rising stem, teflon-impregnated packing with bronze packing nut, threaded or soldered end connections and with aluminum or malleable-iron handwheel.

2.4 BALL VALVES

A. Ball Valves, 4" and Smaller: MSS SP-110, Class 150, 600 psi CWP, ASTM B 584 bronze body and bonnet, two-piece construction, chrome-plated brass ball, standard port for 1/2" valves and smaller and conventional port for 3/4" valves and larger, blowout proof, bronze or brass stem,

teflon seats and seals, threaded or soldered end connections:

1. Operator: Vinyl-covered steel lever handle.
2. Stem Extension: For valves installed in insulated piping.
3. Memory Stop: For operator handles.

2.5 PLUG VALVES

A. Plug Valves: MSS SP-78, 175 psi CWP, ASTM A 126 cast-iron body and bonnet, cast-iron plug, Buna N, Viton, or teflon packing, flanged or grooved end connections:

1. Operator: Square head with 1 wrench for every 10 valves.

2.6 GLOBE VALVES

A. Globe Valves, 2-1/2" and Smaller: MSS SP-80, Class 125, 200 psi CWP or Class 150, 300 psi CWP, ASTM B 62 cast-bronze body and screwed bonnet, rubber, bronze or teflon disc, silicon bronze-alloy stem, teflon-impregnated packing with bronze nut, threaded or soldered end connections and with aluminum or malleable-iron handwheel.

2.7 CHECK VALVES

A. Swing Check Valves, 2-1/2" and Smaller: MSS SP-80; Class 125, 200 psi CWP or Class 150, 300 psi CWP; horizontal swing, Y-pattern, ASTM B 62 cast-bronze body and cap, rotating bronze disc with rubber seat or composition seat, threaded or soldered end connections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length and material. Check gasket material for proper size, material composition suitable for service and freedom from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION

A. Install valves as indicated, according to manufacturer's written instructions.

B. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate

the general arrangement of piping, fittings and specialties.

C. Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance and equipment removal without system shutdown.

D. Locate valves for easy access and provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above the center of the pipe.

F. Install valves in a position to allow full stem movement.

G. Installation of Check Valves: Install for proper direction of flow as follows:

1. Swing Check Valves: Horizontal position with hinge pin level.

3.3 SOLDERED CONNECTIONS

A. Cut tube square and to exact lengths.

B. Clean end of tube to depth of valve socket with steel wool, sand cloth or a steel wire brush to a bright finish. Clean valve socket.

C. Apply proper soldering flux in an even coat to inside of valve socket and outside of tube.

D. Open gate and globe valves to fully open position.

E. Remove the cap and disc holder of swing check valves having composition discs.

F. Insert tube into valve socket, making sure the end rests against the shoulder inside valve. Rotate tube or valve slightly to ensure even distribution of the flux.

G. Apply heat evenly to outside of valve around joint until solder melts on contact. Feed solder until it completely fills the joint around tube. Avoid hot spots or overheating valve. Once the solder starts cooling, remove excess amounts around the joint with a cloth or brush.

3.4 THREADED CONNECTIONS

A. Note the internal length of threads in valve ends and proximity of valve internal seat or wall to determine how far pipe should be threaded into valve.

B. Align threads at point of assembly.

C. Apply appropriate tape or thread compound to the external pipe threads, except where dry seal threading is specified.

D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

3.5 FLANGED CONNECTIONS

A. Align flange surfaces parallel.
B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

C. For dead-end service, butterfly valves require flanges both upstream and downstream for proper shutoff and retention.

3.6 VALVE END SELECTION

A. Select valves with the following ends or types of pipe/tube connections:

1. Copper Tube Size, 2-1/2" and Smaller: Solder ends.
2. Steel Pipe Sizes, 2" and Smaller: Threaded or grooved end.
3. Steel Pipe Sizes, 2-1/2" and Larger: Grooved end or flanged.

3.7 APPLICATION SCHEDULE

A. General Application: Use gate, ball and butterfly valves for shutoff duty; globe, ball and butterfly for throttling duty. Refer to piping system Specification Sections for specific valve applications and arrangements.

B. Domestic Water Systems: Use the following valve types:

1. Gate Valves: Class 125, bronze or cast-iron body to suit piping system.
2. Ball Valves: Class 150, 600 psi CWP, with stem extension.
3. Plug Valves: Neoprene-faced plug, Buna N packing.
4. Globe Valves: Class 125, bronze or cast-iron body to suit piping system and bronze or teflon disc.
5. Bronze Swing Check: Class 125, with rubber seat.

3.8 ADJUSTING

A. Adjust or replace packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves if leak persists.

END OF SECTION 15100

SECTION 15122 - METERS AND GAUGES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes meters and gauges for mechanical systems and water meters installed outside the building.

B. Related Sections include the following:

1. Mechanical equipment Sections that specify meters and gauges as part of factory-fabricated equipment.

1.3 SUBMITTALS

A. Product Data: Include scale range, ratings and calibrated performance curves for each meter, gauge, fitting, specialty and accessory specified.

B. Shop Drawings: Include schedule indicating manufacturer's number, scale range, fittings and location for each meter and gauge.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Liquid-in-Glass Thermometers:
   a. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
   b. Ernst Gage Co.
   c. Marsh Bellofram.
   d. Palmer Instruments, Inc.
   e. Trerice: H. O. Trerice Co.
   f. Weiss Instruments, Inc.
   g. Winter's Thermogauges, Inc.

2. Insertion Dial Thermometers:
   a. Dresser Industries, Inc.; Instrument Div.; Ashcroft Commercial Sales Operation.
   b. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
   c. Reotemp Instrument Corp.
   d. Tel-Tru Manufacturing Co., Inc.
   e. Trerice: H. O. Trerice Co.
   f. Weiss Instruments, Inc.

3. Pressure Gauges:

a. AMETEK, Inc.; U.S. Gauge Div.
b. Dresser Industries, Inc.; Instrument Div.; Ashcroft Commercial Sales Operation.
c. Dresser Industries, Inc.; Instrument Div.; Weksler Instruments Operating Unit.
d. Ernst Gage Co.
e. Marsh Bellofram.
f. Noshok, Inc.
g. Trerice: H. O. Trerice Co.
h. Weiss Instruments, Inc.
i. WIKA Instruments Corp.
j. Winter's Thermogauges, Inc.

4. Test Plugs:
a. Flow Design, Inc.
b. MG Piping Products Co.
c. National Meter.
d. Peterson Equipment Co., Inc.
e. Sisco Manufacturing Co.
f. Trerice: H. O. Trerice Co.
g. Watts Industries, Inc.; Water Products Div.

2.2 THERMOMETERS, GENERAL

A. Scale Range: Temperature ranges for services listed are as follows:

1. Domestic Hot Water: 30^{o} F to 240^{o} F, with 2-degree scale divisions.
2. Hot Water: 30^{o} F to 300^{o} F, with 2-degree scale divisions.

B. Accuracy: Plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span.

2.3 LIQUID-IN-GLASS THERMOMETERS

A. Description: ASTM E 1.

B. Case: Die-cast and aluminum finished in baked-epoxy enamel, glass front, spring secured, 9" long.

C. Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.

D. Tube: Red or blue reading, organic-liquid filled with magnifying lens.

E. Scale: Satin-faced nonreflective aluminum with permanently-etched markings.

F. Stem: Copper-plated steel, aluminum or brass for separable socket, of length to suit installation.

2.4 INSERTION DIAL THERMOMETERS

A. Description: ASME B40.3, bimetal type.

B. Dial: 1" diameter.

C. Case: Stainless steel.
D. Stem: Dustproof and leakproof 1/8" diameter, tapered-end stem with nominal length of 5.

2.5 THERMOMETER WELLS

A. Description: Fitting with protective well for installation in threaded pipe fitting to hold test thermometer.

1. Material: Brass for use in copper piping; steel for use in steel piping.
2. Extension-Neck Length: Nominal thickness of 2", but not less than thickness of insulation. Omit extension neck for wells for piping not insulated.
3. Insertion Length: To extend to one-third of diameter of pipe.
4. Cap: Threaded with chain permanently fastened to socket.
5. Heat-Transfer Fluid: Oil or graphite.

2.6 PRESSURE GAUGES

A. Description: ASME B40.1, phosphor-bronze bourdon-tube type with bottom connection; dry type unless liquid-filled-case type is indicated.

B. Case: Drawn steel, brass or aluminum with 4-1/2" diameter, glass lens.

C. Connector: Brass, NPS 1/4.

D. Scale: White-coated aluminum with permanently-etched markings.

E. Accuracy: Grade A, plus or minus 1 percent of middle 50 percent of scale.

F. Range: Comply with the following:

1. Fluids under Pressure: Two times the operating pressure.

2.7 PRESSURE-GAUGE FITTINGS

A. Valves: NPS 1/4 brass or stainless steel needle type.

B. Syphons: NPS 1/4 coil of brass tubing with threaded ends.

C. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure.

2.8 TEST PLUGS

A. Description: Nickel-plated, brass-body test plug in NPS 1/2 fitting.

B. Body: Length as required to extend beyond insulation.

C. Pressure Rating: 500 psig minimum.

D. Core Inserts: Two self-sealing valves suitable for inserting 1/8" OD probe from dial-type thermometer or pressure gauge.

E. Core Material for Air, Water, Oil and Gas: 20^{o} F to 200^{o} F, chlorosulfonated polyethylene synthetic rubber.

F. Test-Plug Cap: Gasketed and threaded cap, with retention chain or strap.

G. Test Kit: Pressure gauge and adapter with probe, two bimetal dial thermometers and carrying case.

1. Pressure Gauge and Thermometer Ranges: Approximately two times the system's operating conditions.

PART 3 - EXECUTION

3.1 METER AND GAUGE INSTALLATION, GENERAL

A. Install meters, gauges and accessories according to manufacturer's written instructions for applications where used.

3.2 THERMOMETER INSTALLATION

A. Install thermometers and adjust vertical and tilted positions.

B. Install in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic boiler.

C. Install thermometer wells in vertical position in piping tees where test thermometers are indicated.

1. Install with stem extending to center of pipe.
2. Fill wells with oil or graphite and secure caps.

3.3 PRESSURE-GAUGE INSTALLATION

A. Install pressure gauges in piping tees with pressure-gauge valve located on pipe at most readable position.

B. Install dry-type pressure gauges in the following locations:

1. Building water-service entrance.

C. Install liquid-filled-type pressure gauges at suction and discharge of each pump.

D. Install pressure-gauge needle valve and snubber in piping to pressure gauges.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping and specialties. The following are specific connection requirements:

1. Install meters and gauges adjacent to machines and equipment to allow service and maintenance.

3.5 ADJUSTING AND CLEANING

A. Calibrate meters according to manufacturer's written instructions, after installation.

B. Adjust faces of meters and gauges to proper angle for best visibility.

C. Clean windows of meters and gauges and clean factory-finished surfaces. Replace cracked and broken windows and repair scratched and marred surfaces with manufacturer's touchup paint.

END OF SECTION 15122

SECTION 15140 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes domestic water piping from locations indicated to fixtures and equipment inside the building.

B. Related Sections include the following:

1. Division 15 Section "Meters and Gauges" for thermometers, pressure gages, and fittings.
2. Division 15 Section "Plumbing Specialties" for water distribution piping specialties.

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Service Piping: 160 psig.
2. Domestic Water Distribution Piping: 125 psig.

1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings and couplings.

B. Water Samples: Specified in "Cleaning" Article in Part 3.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp or other markings of specified testing agency.

B. Comply with NS 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting and joining materials.

B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be

joined.

C. Transition Couplings for Underground Pressure Piping: AWWA C219, metal, sleeve-type coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 COPPER TUBING

A. Hard Copper Tube: ASTM B 88, Types K and L, water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18 cast-copper-alloy or ASME B16.22 wrought-copper solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123 cast-copper-alloy hexagonal-stock body with ball-and-socket metal-to-metal seating surfaces and solder-joint or threaded ends.

2.3 VALVES

A. Refer to Division 15 Section "Valves" for bronze and cast-iron general-duty valves.

B. Refer to Division 15 Section "Plumbing Specialties" for balancing and drain valves.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching and backfilling.

3.2 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Fitting Option: Mechanically-formed tee-branch outlets and brazed joints may be used on aboveground copper tubing.

D. Underground Domestic Water Service Piping: Use the following piping materials for each size range:

1. NPS 4 and Smaller: Hard copper tube, Type K, copper pressure fittings and soldered joints and two layers of scotch wrap.

E. Aboveground Domestic Water Piping: Use the following piping materials for each size range:

1. NPS 4 and Smaller: Hard copper tube, Type L, copper pressure fittings and soldered joints.

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the

following requirements apply:

1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water-Piping, Balancing Duty: [Calibrated] [Memory-stop] balancing valves.
4. Drain Duty: Hose-end drain valves.

3.4 PIPING INSTALLATION

A. Refer to Division 2 Section "Water Distribution" for site water distribution and service piping.

B. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.

C. Extend domestic water service piping to exterior water distribution piping in sizes and locations indicated.

D. Install underground copper tubing according to CDA's "Copper Tube Handbook." Wrap with two layers of scotch wrap.

E. Install shutoff valve, hose-end drain valve, strainer, pressure gauge and test tee with valve, inside building at each domestic water service. Refer to Division 15 Section "Meters and Gauges" for pressure gauges and Division 15 Section "Plumbing Specialties" for drain valves and strainers.

F. Install water-pressure regulators downstream from shutoff valves. Refer to Division 15 Section "Plumbing Specialties" for water-pressure regulators.

G. Install aboveground domestic water piping level with 0.25 percent slope downward toward drain and plumb.

H. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

I. Perform the following steps before operation:

1. Close drain valves, hydrants and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.

J. Check plumbing equipment and verify proper settings, adjustments and operation. Do not operate water heaters before filling with water.

K. Check plumbing specialties and verify proper settings, adjustments and operation.

1. Water-Pressure Regulators: Set outlet pressure at 80 psig maximum, unless otherwise indicated.

L. Energize pumps and verify proper operation.

3.5 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Soldered Joints: Use ASTM B 813, water-flushable lead-free flux, ASTM B 32, lead-free-alloy solder and ASTM B 828 procedure, unless otherwise indicated.

C. Mechanically Formed Outlets: Form tee in copper tube according to equipment manufacturer's written instructions. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop and braze branch tube into collar.

3.6 VALVE INSTALLATION

A. Install sectional valve close to water main on each branch and riser serving plumbing fixtures or equipment. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.

B. Install shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.

C. Install drain valves for equipment, at base of each water riser, at low points in horizontal piping and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers and branches.

D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Refer to Division 15 Section "Plumbing Specialties" for balancing valves.

3.7 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:
   a. 100 Feet and Less: MSS Type 1, adjustable steel clevis hangers.

B. Install supports according to Division 15 Section "Hangers and Supports."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8".

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60" with 3/8" rod.
2. NPS 1 and NPS 1-1/4: 72" with 3/8" rod.

3. NPS 1-1/2 and NPS 2: 96" with 3/8" rod.
4. NPS 2-1/2: 108" with 1/2" rod.
5. NPS 3 to NPS 5: 10 feet with 1/2" rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.8 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to service piping with shutoff valve and extend and connect to the following:

1. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.9 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:

1. Do not enclose, cover or put piping into operation until it is inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
   a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended or replaced domestic water piping until it has been tested and approved. Expose work that was covered or

concealed before it was tested.

3. Cap and subject piping to static water pressure of 50 psig above operating pressure without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.10 ADJUSTING

A. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

1. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
2. Adjust calibrated balancing valves to flows indicated.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:
        1. Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
        2. Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 15140

SECTION 15150 - SANITARY WASTE AND VENT PIPING

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes soil and waste, sanitary drainage and vent piping inside the building and to locations indicated.

B. Related Sections include the following:

1. Division 15 Section "Plumbing Specialties" for soil, waste and vent piping systems specialties.

1.3 DEFINITIONS

A. The following are industry abbreviations for plastic piping materials:

1. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Soil, Waste and Vent Piping: 10-foot head of water.

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings and couplings.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting and joining materials.

B. Flexible Transition Couplings for Underground Nonpressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.

2.2 PVC PIPING

A. PVC Pipe: ASTM D 2665 solid-wall drain, waste and vent.

1. PVC Socket Fittings: ASTM D 2665 socket type, made to ASTM D 3311 drain, waste and vent patterns.

B. Cellular-Core Schedule 40 PVC Pipe: ASTM F 891, Schedule 40.

1. PVC Socket Fittings: ASTM D 2665 made to ASTM D 3311 drain, waste and vent patterns and to fit Schedule 40 pipe.

C. Cellular-Core Sewer and Drain Series PVC Pipe: ASTM F 891, Series PS 100.

1. PVC Socket Fittings: ASTM D 2665 made to ASTM D 3311 drain, waste and vent patterns and to fit Series PS 100 sewer and drain pipe.

D. PVC Special Fittings: ASTM F 409 drainage-pattern tube and tubular fittings with ends as required for application.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching and backfilling.

3.2 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground pressure piping, unless otherwise indicated.

C. Aboveground Soil, Waste and Vent Piping: Use [any of] the following piping materials for each size range:

1. NPS 1-1/4 and NPS 1-1/2: PVC pipe, PVC socket fittings and solvent-cemented joints.
2. NPS 2 to NPS 4: PVC pipe, PVC socket fittings and solvent-cemented joints.

D. Underground Soil, Waste and Vent Piping: Use [any of] the following piping materials for each size range:

1. NPS 1-1/2: PVC pipe, PVC socket fittings and solvent-cemented joints.
2. NPS 2 to NPS 4: PVC pipe, PVC socket fittings and solvent-cemented joints.

3.3 PIPING INSTALLATION

A. Refer to Division 2 Section "Sanitary Sewerage" for Project-site sanitary sewer piping.

B. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.

C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

D. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

E. Underground Ductile-Iron Force-Main Piping: Comply with AWWA C600. Install buried piping inside the building between wall and floor penetrations and connection to sanitary sewer piping outside the building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

F. Install cast-iron sleeve with water-stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.

G. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

H. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements and other installation requirements. Maintain swab in piping and pull past each joint as completed.

I. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

J. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

K. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

L. Do not enclose, cover or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42 clamps.
2. Individual Straight Horizontal Piping Runs: According to the following:
   a. 100 Feet and Less: MSS Type 1 adjustable steel clevis hangers.

B. Install supports according to Division 15 Section "Hangers and Supports."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8" minimum rods.

E. Install hangers for PVC]piping with the following maximum horizontal spacing and minimum rod diameters per MSS SP-69:

1. NPS 1-1/2 and NPS 2: 48".
2. NPS 3: 48".
3. NPS 4 and NPS 5: 48".

F. Install supports for vertical PVC piping every 48".

G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Specialties."
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PROTECTION

A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 15150

SECTION 15181 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes piping, special-duty valves and hydronic specialties for hot-water heating, makeup water for these systems and blowdown drain lines.

B. Related Sections include the following:

1. Division 15 Section "Basic Mechanical Materials and Methods" for general piping materials and installation requirements.
2. Division 15 Section "Hangers and Supports" for pipe supports, product descriptions and installation requirements. Hanger and support spacing is specified in this Section.
3. Division 15 Section "Valves" for general-duty gate, globe, ball, butterfly and check valves.
4. Division 15 Section "Meters and Gauges" for thermometers, flow meters and pressure gauges.
5. Division 15 Section "Hydronic Pumps" for pumps, motors and accessories for hydronic piping.

1.3 SUBMITTALS

A. Product Data: For each type of special-duty valve indicated. Include flow and pressure drop curves based on manufacturer's testing for calibrated balancing valves and automatic flow-control valves.

B. Shop Drawings: Detail fabrication of pipe anchors, hangers, special pipe support assemblies, alignment guides, expansion joints and loops and their attachment to the building structure. Detail location of anchors, alignment guides and expansion joints and loops.

C. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Failed test results and corrective action taken to achieve requirements.

D. Maintenance Data: For hydronic specialties and special-duty valves to include in maintenance manuals specified in Division 1.

E. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.4 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials,

products and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

1.5 COORDINATION

A. Coordinate layout and installation of hydronic piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components and partition assemblies.

B. Coordinate pipe sleeve installations for foundation wall penetrations.

C. Coordinate piping installation with roof curbs, equipment supports and roof penetrations. Roof specialties are specified in Division 7 Sections.

D. Coordinate pipe fitting pressure classes with products specified in related Sections.

E. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement and formwork requirements are specified in Division 3 Sections.

F. Coordinate installation of pipe sleeves for penetrations through floor assemblies.

1.6 EXTRA MATERIALS

A. Water Treatment Chemicals: Furnish sufficient chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Grooved Mechanical-Joint Fittings and Couplings:
   a. Central Sprinkler Company; Central Grooved Piping Products.
   b. Grinnell Corporation.
   c. Victaulic Company of America.

2. Calibrated Balancing Valves:
   a. Armstrong Pumps, Inc.
   b. Flow Design, Inc.
   c. Gerand Engineering Company.
   d. Griswold Controls.
   e. ITT Bell & Gossett; ITT Fluid Technology Corp.
   f. Taco, Inc.

3. Pressure-Reducing Valves:
   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. Conbraco Industries, Inc.
   d. ITT Bell & Gossett; ITT Fluid Technology Corp.
   e. Spence Engineering Company, Inc.
   f. Watts Industries, Inc.; Watts Regulators.

4. Safety Valves:
   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. Conbraco Industries, Inc.
   d. ITT McDonnell & Miller Div.; ITT Fluid Technology Corp.
   e. Kunkle Valve Division.
   f. Spence Engineering Company, Inc.

5. Expansion Tanks:
   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. ITT Bell & Gossett; ITT Fluid Technology Corp.
   d. Taco, Inc.

6. Air Separators and Air Purgers:
   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. ITT Bell & Gossett; ITT Fluid Technology Corp.
   d. Taco, Inc.

2.2 PIPING MATERIALS

A. General: Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

2.3 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32, 95-5 tin antimony.

E. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (silver).

2.4 STEEL PIPE AND FITTINGS

A. Steel Pipe, NPS 2 and Smaller: ASTM A 53, Type S (seamless) or Type F (furnace-butt welded), Grade A, Schedule 40, black steel, plain ends.

B. Steel Pipe, NPS 2-1/2 through NPS 12: ASTM A 53, Type E (electric-resistance welded), Grade A, Schedule 40, black steel, plain ends.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.

E. Grooved Mechanical-Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47, Grade 32510 malleable iron; ASTM A 53, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders designed to accept grooved end couplings.

F. Grooved Mechanical-Joint Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design with nuts, bolts, locking pin, locking toggle

or lugs to secure grooved pipe and fittings.

G. Welding Materials: Comply with Section II, Part C, of the ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

2.5 VALVES

A. Gate, globe, check, ball and butterfly valves are specified in Division 15 Section "Valves."

B. Refer to Part 3 "Valve Applications" Article for applications of each valve.

C. Calibrated Balancing Valves, NPS 2 and Smaller: Bronze body, ball type, 125-psig working pressure, 250° F maximum operating temperature and having threaded ends. Valves shall have calibrated orifice or venturi, connections for portable differential pressure meter with integral seals and be equipped with a memory stop to retain set position.

D. Pressure-Reducing Valves: Diaphragm-operated, bronze or brass body with low inlet pressure check valve, inlet strainer removable without system shutdown and noncorrosive valve seat and stem. Select valve size, capacity and operating pressure to suit system. Valve shall be factory set at operating pressure and have capability for field adjustment.

E. Safety Valves: Diaphragm-operated, bronze or brass body with brass and rubber, wetted, internal working parts; shall suit system pressure and heat capacity and shall comply with the ASME Boiler and Pressure Vessel Code, Section IV.

2.6 HYDRONIC SPECIALTIES

A. Manual Air Vent: Bronze body and nonferrous internal parts; 150-psig working pressure, 225° F operating temperature, manually operated with screwdriver or thumbscre,; with NPS 1/8 discharge connection and NPS 1/2 inlet connection.

B. Expansion Tanks: Welded carbon steel, rated for 125-psig working pressure and 375° F maximum operating temperature. Separate air charge from system water to maintain design expansion capacity by a flexible diaphragm securely sealed into tank. Include drain fitting and taps for pressure gauge and air-charging fitting. Support vertical tanks with steel legs or base; support horizontal tanks with steel saddles. Factory fabricate and test tank with taps and supports installed and labeled according to the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

C. Air Purgers: Cast-iron body with internal baffles that slow the water velocity to separate the air from solution and divert it to the vent for quick removal. Maximum working pressure of 150 psig and temperature of 250° F.

D. Bypass Chemical Feeder: Welded steel construction; 125-psig working pressure; 5-gal. capacity, with fill funnel and inlet, outlet and drain valves.

1. Chemicals: Specially formulated, based on analysis of make-up water, to prevent accumulation of scale and corrosion in piping and connected equipment.

D. Y-Pattern Strainers: 125-psig working pressure; cast-iron body (ASTM A 126, Class B), flanged ends for NPS 2-1/2 and larger, threaded connections for NPS 2 and smaller, bolted cover, perforated stainless steel basket and bottom drain connection.

PART - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot Water, NPS 2 and Smaller: Aboveground, use Type L drawn-temper copper tubing with soldered joints or Schedule 40 steel pipe with threaded joints.

B. Hot Water, NPS 2-1/2 and Larger: Schedule 40 steel pipe with welded and flanged joints or grooved mechanical-joint couplings.

3.2 VALVE APPLICATIONS

A. General-Duty Valve Applications: Unless otherwise indicated, use the following valve types:

1. Shutoff Duty: Gate, ball and butterfly valves.
2. Throttling Duty: Globe, ball,and butterfly valves.

B. Install shutoff duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, unless only one piece of equipment is connected in the branch line. Install throttling duty valves at each branch connection to return mains, at return connections to each piece of equipment and elsewhere as indicated.

C. Install calibrated balancing valves in the return water line of each heating or cooling element and elsewhere as required to facilitate system balancing.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install safety valves on hot-water generators and elsewhere as required by the ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to floor. Comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, for installation requirements.

F. Install pressure-reducing valves on hot-water generators and elsewhere as required to regulate system pressure.

3.3 PIPING INSTALLATIONS

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation requirements.

B. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

C. Install drains, consisting of a tee fitting, NPS 3/4 ball valve and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

D. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

E. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

F. Unless otherwise indicated, install branch connections to mains using tee fittings in main pipe, with the takeoff coming out the bottom of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.

G. Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, in-line pump and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown

connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

H. Anchor piping for proper direction of expansion and contraction.

3.4 HANGERS AND SUPPORTS

A. Hanger, support and anchor devices are specified in Division 15 Section "Hangers and Supports." Comply with requirements below for maximum spacing of supports.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.

C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes per MSS SP-69:

1. NPS 3/4: Maximum span, 7 feet.
2. NPS 1: Maximum span, 7 feet.
3. NPS 1-1/2: Maximum span, 9 feet.
4. NPS 2: Maximum span, 10 feet.
5. NPS 2-1/2: Maximum span, 11 feet.

D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4".
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4".
3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8".
4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8".

E. Support vertical runs at roof, at each floor and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for joint construction requirements for soldered and brazed joints in copper tubing; threaded, welded and flanged joints in steel piping.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils and elsewhere as required for system air venting.

B. Install in-line air separators in pump suction lines. Install piping to compression tank with a 2 percent upward slope toward tank. Install drain valve on units NPS 2 and larger.

C. Install combination air separator and strainer in pump suction lines. Install piping to compression tank with a 2 percent upward slope toward tank. Install blowdown piping with gate valve; extend to nearest drain.

D. Install bypass chemical feeders in each hydronic system where indicated in upright position with top of funnel not more than 48" above floor. Install feeder in bypass line, off main, using globe valves on each side of feeder and in the main between bypass connections. Pipe drain, with ball valve, to nearest equipment drain.

E. Install expansion tanks on floor. Vent and purge air from hydronic system and ensure tank is properly charged with air to suit system design requirements.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Size for supply and return piping connections shall be same as for equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If multiple parallel control valves are installed, only one bypass is required.

D. Install ports for pressure and temperature gauges at coil inlet connections.

3.8 CHEMICAL TREATMENT

A. Fill system with 40% inhibited propylene glycol after cleaning.

3.9 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush system with clean water. Clean strainers.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.
3. Check expansion tanks to determine that they are not air bound and that system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints and connections for leakage. Eliminate leaks by tightening, repairing or replacing components and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

3.10 ADJUSTING

A. Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed to permanently indicate final balanced position.

B. Perform these adjustments before operating the system:

1. Open valves to fully open position. Close coil bypass valves.
2. Check pump for proper direction of rotation.
3. Set automatic fill valves for required system pressure.
4. Check air vents at high points of system and determine if all are installed and operating freely (automatic type) or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Check operation of automatic bypass valves.
7. Check and set operating temperatures of boilers, chillers and cooling towers to design requirements.
8. Lubricate motors and bearings.

3.11 CLEANING

A. Flush hydronic piping systems with clean water. Remove and clean or replace strainer screens. After cleaning and flushing hydronic piping systems, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.

END OF SECTION 15181

SECTION 15185 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following categories of hydronic pumps for hydronic systems:

1. In-line circulators.

1.3 SUBMITTALS

A. Product Data: Include certified performance curves and rated capacities, shipping, installed and operating weights, furnished specialties, final impeller dimensions and accessories for each type of product indicated. Indicate pump's operating point on curves.

B. Shop Drawings: Show pump layout and connections. Include Setting Drawings with templates for installing foundation and anchor bolts and other anchorages.

1. Wiring Diagrams: Detail wiring for power, signal and control systems and differentiate between manufacturer-installed and field-installed wiring.

C. Maintenance Data: For pumps to include in maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

A. UL Compliance: Fabricate and label pumps to comply with UL 778, "Motor-Operated Water Pumps," for construction requirements.

B. Product Options: Drawings indicate size, profiles, connections and dimensional requirements of pumps and are based on the specific types and models indicated. Other manufacturers' pumps with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

C. Regulatory Requirements: Fabricate and test steam condensate pumps to comply with HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation," and HI 1.6, "Centrifugal Pump Tests."

D. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE AND HANDLING

A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anti-corrosion compound after assembly and testing. Protect flanges, pipe openings and nozzles with wooden flange covers or with screwed-in plugs.

B. Store pumps in dry location.

C. Retain protective covers for flanges and protective coatings during storage.

D. Protect bearings and couplings against damage from sand, grit and other foreign matter.

E. Comply with pump manufacturer's written rigging instructions.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. In-Line Circulators:
   a. Amtrol, Inc.
   b. Armstrong Pumps, Inc.
   c. Bell & Gossett ITT; Div. of ITT Fluid Technology Corp.
   d. Burks Pumps, Inc.; Div. of Crane Pumps & Systems, Inc.
   e. Grundfos Pumps Corp.
   f. MEPCO (Marshall Engineering Products Co.).
   g. Scot Pump; Div. of Ardox Corp.
   h. Taco; Fabricated Products Div.

2.2 GENERAL PUMP REQUIREMENTS

A. Pump Units: Factory assembled and tested.

B. Motors: Include built-in thermal-overload protection and grease-lubricated ball bearings. Select each motor to be nonoverloading over full range of pump performance curve.

C. Motors to Be Energy Efficient: Minimum efficiency as indicated according to IEEE 112, Test Method B. Include motors with higher efficiency than "average standard industry motors" according to IEEE 112, Test Method B, if efficiency is not indicated.

2.3 IN-LINE CIRCULATORS

A. Description: Horizontal, in-line, centrifugal, single-stage, bronze-fitted, radially split case design; rated for 125-psig minimum working pressure and a continuous water temperature of 225^{o} F.

1. Casing: Cast-iron with threaded companion flanges for piping connections and threaded gauge tappings at inlet and outlet connections.
   a. Connection Option: Unions at connections for casings that are not available with threaded companion flanges.
2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, closed, overhung, single suction and keyed to shaft.
3. Shaft and Sleeve: Steel shaft with oil-lubricated copper sleeve.
4. Seals: Mechanical type. Include carbon-steel rotating ring, stainless steel spring, ceramic seat and flexible bellows and gasket.
5. Pump Bearings: Oil-lubricated, bronze journal and thrust type.

6. Motor Bearings: Oil-lubricated, sleeve type.
7. Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
8. Motor: Resiliently mounted to pump casing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation.

1. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PUMP INSTALLATION

A. Install pumps according to manufacturer's written instructions.

1. Install pumps according to HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."

B. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings and accessories.

C. Support pumps and piping separately so piping is not supported by pumps.

D. Suspend in-line pumps using continuous-thread hanger rod and vibration-isolation hangers. Install seismic bracing.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect piping to pumps. Install valves that are the same size as piping connected to pumps.

D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

E. Install nonslam check valve and throttling valve on discharge side of in-line circulators.

F. Install shutoff valve on suction side of in-line pumps.

G. Install pressure gauges on pump suction and discharge. Install at integral pressure-gauge tappings where provided.

H. Install temperature and pressure-gauge connector plugs in suction and discharge piping around each pump.

I. Install electrical connections for power, controls and devices.

J. Electrical power and control wiring and connections are specified in Division 16 Sections.

K. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 COMMISSIONING

A. Verify that pumps are installed and connected according to the Contract Documents.

B. Verify that electrical wiring installation complies with manufacturer's written instructions and the Contract Documents.

C. Perform the following preventive maintenance operations and checks before starting:

1. Lubricate bearings.
2. Disconnect coupling and check motor for proper rotation that matches direction marked on pump casing.
3. Verify that pumps are free to rotate by hand and that pumps for handling hot liquids are free to rotate with pumps hot and cold. Do not operate pumps if they are bound or drag until cause of trouble is determined and corrected.
4. Check suction piping connections for tightness to avoid drawing air into pumps.
5. Clean strainers.
6. Verify that pump controls are correct for required application.

D. Starting procedure for pumps with shutoff power not exceeding safe motor power is as follows:

1. Prime pumps by opening suction valves and closing drains and prepare pumps for operation.
2. Open sealing liquid-supply valves if pumps are so fitted.
3. Open warm-up valves of pumps handling hot liquids if pumps are not normally kept at operating temperature.
4. Open circulating line valves if pumps should not be operated against dead shutoff.
5. Start motors.
6. Open discharge valves slowly.
7. Check general mechanical operation of pumps and motors.

E. Refer to Division 15 Section "Testing, Adjusting and Balancing" for detailed requirements for testing, adjusting and balancing hydronic systems.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain hydronic pumps as specified below:

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing and maintaining pumps.
2. Review data in maintenance manuals.
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 15185

SECTION 15189 - HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes water-treatment systems for the following:

1. Heating hot-water piping (closed-loop system).

1.3 CHEMICAL FEED SYSTEM DESCRIPTION

A. Closed-Loop System: One bypass feeder on each system with isolating and drain valves downstream from circulating pumps, unless otherwise indicated.

1. Introduce chemical treatment through bypass feeder when required or indicated by test.

1.4 PERFORMANCE REQUIREMENTS

A. Maintain water quality for HVAC systems that controls corrosion and build-up of scale and biological growth for maximum efficiency of installed equipment without posing a hazard to operating personnel or the environment.

B. Base chemical treatment performance requirements on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities and requirements and guidelines of authorities having jurisdiction.

1. Closed System: Maintain system essentially free of scale, corrosion and fouling to sustain the following water characteristics:
   a. Copper: .01 ppm.
   b. pH: 9.0 to 10.5.
   c. Nitrite: 600 ppm minimum.
2. NOTE: Fill system with 40% inhibited propylene glycol by weight after cleaning.

1.5 SUBMITTALS

A. Product Data: Include rated capacities, water-pressure drops, shipping, installed and operating weights and furnished products listed below:

1. Test equipment.
2. Chemicals.
3. Chemical feeders.

B. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is an authorized representative of the chemical treatment manufacturer for both installation and maintenance of chemical treatment equipment required for this Project.

B. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Chemicals: Furnish quantity equal to 30% of amount initially installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. HVAC Water-Treatment Products:
   a. Ampion Corp.
   b. Anderson Chemical Co., Inc.
   c. Aqua-Chem, Inc.; Cleaver-Brooks Div.
   d. Barclay Chemical Co., Water Management, Inc.
   e. Betz Dearborn, Inc.
   f. Calgon Corp., ECC International.
   g. Diversey Water Technologies, Inc.
   h. DuBois Chemicals, Inc.; DuBois USA Subsidiary.
   i. Fluids Pumps & Controllers, Inc.
   j. Harmsco Industrial Filters.
   k. Metro Group., Inc.; Metropolitan Refining Div.
   l. Nalco Chemical Co.
   m. Selick & Bird, Inc.
   n. Stewart-Hall, Div. of the Rectorseal Corp.
   o. Trane Boland Services; Water Treatment.
   p. Watcon, Inc.

2.2 CHEMICAL FEEDING EQUIPMENT

A. Bypass Feeders: Cast-iron or steel for introducing chemicals into system, with funnel shutoff valve on top, air-release valve on top, drain valve on bottom and recirculating shutoff valves on sides.

1. Capacity: 1.8 gallons.
2. Working Pressure: 125 psig.

2.3 CHEMICAL TREATMENT TEST EQUIPMENT

A. Test Kit: Manufacturer-recommended equipment and chemicals in a carrying case for testing pH, total dissolved solids, dissolved oxygen, biocount, chloride, total alkalinity and for calcium hardness field tests.

2.4 CHEMICALS

A. Furnish chemicals recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment.

B. System Cleaner: Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products.

1. Quantity: As required.

PART 3 - EXECUTION

3.1 WATER ANALYSIS

A. Perform an analysis of supply water to determine the type and quantities of chemical treatment needed to maintain the water quality as specified in "Performance Requirements" Article.

3.2 INSTALLATION

A. Install treatment equipment level and plumb.

B. Add cleaning chemicals as recommended by manufacturer.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.4 FIELD QUALITY CONTROL

A. Engage a factory-authorized service representative to perform startup service.

1. Inspect field-assembled components and equipment installation including piping and electrical connections. Report results in writing.
2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed and filled with water and are fully operational before introducing chemicals for water-treatment system.
3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.

B. Test chemical feed piping as follows:

1. Do not enclose, cover or put piping into operation until it is tested and satisfactory test results are achieved.
2. Test for leaks and defects. If testing is performed in segments, submit separate report for

each test, complete with diagram of portion of piping tested.

3. Leave uncovered and unconcealed new, altered, extended and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
5. Repair leaks and defects with new materials and retest piping until satisfactory results are obtained.
6. Prepare test reports including required corrective action.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain HVAC water-treatment systems and equipment.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing and maintaining equipment and schedules.

B. Review manufacturer's safety data sheets for handling of chemicals.

C. Review data in maintenance manuals, especially data on recommended parts inventory and supply sources and on availability of parts and service.

D. Schedule at least two hours of training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 15189

SECTION 15194 - LP GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes fuel gas piping, specialties and accessories within the building.

1.3 PROJECT CONDITIONS

A. Gas System Pressure: One pressure range. More than 0.5 psig but not more than 2.0 psig.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Specialty valves. Include pressure rating, capacity, settings and electrical connection data of selected models.
2. Pressure regulators. Include pressure rating, capacity and settings of selected models.

B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

C. Maintenance Data: For LP gas specialties and accessories to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

A. Electrical Components and Devices: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction and marked for intended use.

B. International Fuel Gas Code.

C. FM Standard: Provide components listed in FM's "Fire Protection Approval Guide" if specified to be FM approved.

D. IAS Standard: Provide components listed in IAS's "Directory of A. G. A. and C. G. A Certified Appliances and Accessories" if specified to be IAS listed.

E. UL Standard: Provide components listed in UL's "Gas and Oil Equipment Directory" if specified to be UL listed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering

products that may be incorporated into the work include, but are not limited to, the following:

1. Appliance Connector Valves:
   a. American Valve.
   b. B&K Industries, Inc.
   c. Brass Craft Manufacturing Co.
   d. Cimberio Valves, S. p. A.
   e. Conbraco Industries, Inc.; Apollo Div.
   f. E. M. Plastic and Electric Products, Ltd.; Neo Valve Div.
   g. Frey: John M. Frey Co.
   h. Jomar International, Ltd.
   i. Key Gas Components, Inc.
   j. Legend Valve and Fitting, Inc.
   k. McDonald: A. Y. McDonald Mfg. Co.
   l. Mueller Co.; Mueller Gas Products Div.
   m. Newman Hattersley, Ltd.; Specialty Valve Div.
   n. Robert Manufacturing Co.
   o. State Metals, Inc.
   p. Watts Industries, Inc.; Water Products Div.

2. Gas Valves, NPS 2 and Smaller:
   a. BMI Canada, Inc.
   b. Crane Valves.
   c. Dungs: Karl Dungs, Inc.
   d. Flow Control Equipment, Inc.
   e. Grinnell Corp.
   f. Honeywell, Inc.
   g. Jomar International, Ltd.
   h. Kitz Corp. of America.
   i. Legend Valve and Fitting, Inc.
   j. Lyall: R. W. Lyall & Co., Inc.
   k. McDonald: A. Y. McDonald Mfg. Co.
   l. Milwaukee Valve Co., Inc.
   m. Mueller Co.; Mueller Gas Products Div.
   n. Nibco, Inc.
   o. Red-White Valve Corp.
   p. Velan Valve Corp.
   q. Watts Industries, Inc.; Water Products Div.

3. Plug Valves, NPS 2-1/2 and Larger:
   a. Flow Control Equipment, Inc.
   b. Milliken Valve Co., Inc.
   c. Nordstrom Valves, Inc.
   d. Olson Technologies, Inc.; Homestead Valve Div.
   e. Walworth Co.

4. Service Pressure Regulators:
   a. American Meter Co.
   b. Equimeter, Inc.
   c. Fisher Controls International, Inc.
   d. National Meter.
   e. Richards Industries, Inc.; Jordan Valve Div.
   f. Schlumberger Industries; Gas Div.

5. Appliance Pressure Regulators:
    a. Canadian Meter Co., Inc.
    b. Eaton Corp.; Controls Div.
    c. Harper Wyman Co.
    d. Maxitrol Co.
    e. SCP, Inc.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting and joining materials.

2.3 PIPES, TUBES, FITTINGS AND JOINING MATERIALS

A. Steel Pipe: ASTM A 53; Type E or S; Grade B; Schedule 40; black.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.
2. Unions: ASME B16.39, Class 150, malleable-iron with brass-to-iron seat, ground joint and threaded ends according to ASME B1.20.1.
3. Cast-Iron Flanges and Flanged Fittings: ASME B16.1, Class 125.
4. Steel Welding Fittings: ASME B16.9, wrought steel or ASME B16.11, forged steel.
5. Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.
6. Joint Compound and Tape: Suitable for LP gas.
7. Steel Flanges and Flanged Fittings: ASME B16.5.
8. Gasket Material: Thickness, material and type suitable for natural gas.

B. Transition Fittings: Type, material and end connections to match piping being joined.

C. Common Joining Materials: Refer to Division 15 Section "Basic Mechanical Materials and Methods" for joining materials not in this Section.

2.4 PROTECTIVE COATING

A. Furnish pipe and fittings with factory-applied, corrosion-resistant polyethylene coating for use in corrosive atmosphere.

2.5 SPECIALTY VALVES

A. Valves, NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

B. Valves, NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

C. Appliance Connector Valves: ANSI Z21.15 and IAS listed.

D. Gas Stops: Bronze body with AGA stamp, plug type with bronze plug and flat or square head, ball type with chrome-plated brass ball and lever handle or butterfly valve with stainless steel disc and fluorocarbon elastomer seal and lever handle, 2 psig minimum pressure rating.

E. Gas Valves, NPS 2 and Smaller: ASME B16.33 and IAS-listed bronze body and 125-psig pressure rating.

1. Tamperproof Feature: Include design for locking.

F. Plug Valves, NPS 2-1/2 and Larger: ASME B16.38 and MSS SP-78 cast-iron lubricated plug valves with 125-psig pressure rating.

1. Tamperproof Feature: Include design for locking.

2.6 PRESSURE REGULATORS

A. Description: Single stage and suitable for LP gas service. Include jacket and corrosion-resistant components, elevation compensator and atmospheric vent.

1. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
2. NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
3. Appliance Pressure Regulators: ANSI Z21.18. Regulator may include vent limiting device instead of vent connection, if approved by authorities having jurisdiction.

B. Pressure Regulator Vents: Factory- or field-installed, corrosion-resistant screen in opening if not connected to vent piping.

PART 3 - EXECUTION

3.1 PREPARATION

A. Close equipment shutoff valves before turning off fuel gas to premises or section of piping. Perform leakage test as specified in "Field Quality Control" Article to determine that all equipment is turned off in affected piping section.

B. Comply with ANSI Z223.1, "Prevention of Accidental Ignition" Paragraph.

3.2 SERVICE ENTRANCE PIPING

A. Extend fuel gas piping and connect to fuel gas distribution for service entrance to building.

1. Exterior fuel gas distribution system piping, service pressure regulator and tanks will be provided by gas utility.

3.3 PIPING APPLICATIONS

A. Flanges, unions, transition and special fittings with pressure ratings same as or higher than system pressure rating may be used in applications below, unless otherwise indicated.

B. Fuel Gas Piping, 2.0 psig or Less: Use the following:

1. NPS 1/2 and Smaller: NPS 3/4 steel pipe, malleable-iron threaded fittings and threaded joints.
2. NPS 2 and Smaller: Steel pipe, malleable-iron threaded fittings and threaded joints.
3. NPS 2-1/2 to NPS 4: Steel pipe, steel welding fittings and welded joints.
4. Larger Than NPS 4: Steel pipe, steel welding fittings and welded joints.

C. Containment Conduits: Steel pipe, steel welding fittings and welded joints.

3.4 VALVE APPLICATIONS

A. Appliance Shutoff Valves for Pressure 0.5 psig or Less: Appliance connector valve or gas stop.

B. Appliance Shutoff Valves for Pressure 0.5 to 2 psig: Gas stop or gas valve.

C. Piping Line Valves, NPS 2-1/2 and Larger: Plug valve or general-duty valve.

D. Valves at Service Meter, NPS 2-1/2 and Larger: Plug valve.

3.5 PIPING INSTALLATION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation requirements.

B. Concealed Locations: Except as specified below, install concealed gas piping in airtight conduit constructed of Schedule 40, seamless black steel pipe with welded joints. Vent conduit to outside and terminate with screened vent cap.

1. Above-Ceiling Locations: Gas piping may be installed in accessible spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums. Do not locate valves above ceilings.
2. In Partitions: Do not install concealed piping in solid partitions. Protect tubing from physical damage when installed inside partitions or hollow walls.
   a. Exception: Tubing passing through partitions or walls.
3. In Walls: Gas piping with welded joints and protective wrapping specified in "Protective Coating" Article in Part 2 may be installed in masonry walls, subject to approval of authorities having jurisdiction.

C. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of service meters. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3" long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.

D. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors and in floor channels, unless indicated to be exposed to view.

E. Install fuel gas piping at uniform grade of 0.1 percent slope upward toward risers.

F. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

G. Connect branch piping from top or side of horizontal piping.

H. Install unions in pipes NPS 2 and smaller adjacent to each valve, at final connection to each piece of equipment and elsewhere as indicated. Unions are not required on flanged devices.

I. Install flanges on valves, specialties and equipment having NPS 2-1/2 and larger connections.

J. Install vent piping for gas pressure regulators and gas trains, extend outside building and vent to

atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.

K. Install containment conduits for gas piping below slabs, within building, in gastight conduits extending minimum of 4" outside building, and vented to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end. Prepare and paint outside of conduits with coal-tar epoxy-polyamide paint according to SSPC-Paint 16.

3.6 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Use materials suitable for fuel gas.

3.7 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices.

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96"; minimum rod size, 3/8".
2. NPS 1-1/4: Maximum span, 108"; minimum rod size, 3/8".
3. NPS 1-1/2 and NPS 2: Maximum span, 108"; minimum rod size, 3/8".
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2".
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8".

3.8 CONNECTIONS

A. Drawings indicate general arrangement of fuel gas piping, fittings and specialties.

B. Install piping adjacent to appliances to allow service and maintenance.

C. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 72" of each appliance. Install union downstream from valve.

D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.

E. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
2. Do not use gas pipe as grounding electrode.

3.9 FIELD QUALITY CONTROL

A. Inspect, test and purge piping according to ANSI Z223.1, Part 4 "Inspection, Testing and Purging" and requirements of authorities having jurisdiction.

B. Repair leaks and defects with new materials and retest system until satisfactory results are

obtained.

C. Report test results promptly and in writing to Architect and authorities having jurisdiction.

D. Verify capacities and pressure ratings of pressure regulators, valves and specialties.

E. Verify correct pressure settings for pressure regulators.

F. Verify that specified piping tests are complete.

3.10 ADJUSTING

A. Adjust controls and safety devices. Replace damaged and malfunctioning controls and safety devices.

END OF SECTION 15194

SECTION 15211 - GENERAL-SERVICE COMPRESSED-AIR PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes piping and related specialties for general-service compressed-air systems operating at 200 psig and less.

B. Related Sections include the following:

1. Division 15 Section "General-Service Compressed-Air Equipment" for compressed-air equipment and accessories.

1.3 DEFINITIONS

A. Low-Pressure Compressed-Air Piping: System of compressed-air piping and specialties operating at pressures of 125 psig and less.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Pipes, tubes and fittings.
2. Flexible pipe connectors.
3. Safety valves.
4. Pressure regulators.
5. Filters.
6. Automatic drain valves.
7. Quick couplings.

B. Welding Certificates: As required by ASME Boiler and Pressure Vessel Code, Section IX.

C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASME B31.9, "Building Services Piping," for low-pressure compressed-air piping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for

product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting and joining materials.

2.3 PIPES, TUBES AND FITTINGS

A. Schedule 40, Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, black or hot dip, zinc coated. Provide Type S, Grade B, and hot-dip zinc-coated pipe options if indicated.

1. Steel Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Fittings: ASME B16.3, Class 150 or 300, threaded. Provide Class 300 and galvanized finish if indicated.
3. Malleable-Iron Unions: ASME B16.39, Class 150 or 300, threaded. Provide Class 300 if indicated.
4. Wrought-Steel Fittings: ASME B16.9, Schedule 40, butt welding.
5. Forged-Steel Fittings: ASME B16.11, socket type.
6. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel. Provide Class 300 if indicated.
7. Steel-Piping Grooved-End Fittings: ASTM A 47/A 47M, malleable-iron casting, ASTM A 106, steel pipe or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe and made by keyed-coupling manufacturer. Provide galvanized finish if indicated.
    a. Steel-Piping Keyed Couplings: AWWA C606 or UL 213 for steel-pipe dimensions and rated for 300-psig minimum working pressure. Include ferrous housing sections, gasket suitable for compressed air and bolts and nuts. Provide FPM or NBR gasket if indicated. Do not provide EPDM gasket if compressed air contains oil or oil vapor.
        1) Available Manufacturers:
            a) Central Sprinkler Co.; Central Grooved Piping Products.
            b) Grinnell Corp.
            c) Star Pipe Products, Inc.; Star Fittings Div.
            d) Victaulic Corp. of America.
            e) Ward Manufacturing, Inc.

B. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.4 JOINING MATERIALS

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for joining materials not in this Section.

2.5 VALVES

A. General-Duty Valves: Refer to Division 15 Section "Valves" for metal ball, butterfly, check, gate and globe general-duty valves.

2.6 SPECIALTIES

A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled and factory sealed; constructed of bronze body with poppet safety valve for compressed-air service.

1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.

B. Air-Main Pressure Regulators: Bronze body, direct acting, spring-loaded manual pressure-setting adjustment and rated for 250 psig inlet pressure, unless otherwise indicated.

1. Type: Pilot operated.

C. Air-Line Pressure Regulators: Aluminum alloy or plastic body, diaphragm operated, direct acting, spring-loaded manual pressure-setting adjustment and rated for 200 psig minimum inlet pressure, unless otherwise indicated.

D. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols, with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded.

E. Automatic Drain Valves: Corrosion-resistant metal body and internal parts, rated for 200 psig minimum working pressure, capable of automatic discharge of collected condensate.

F. Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.

1. Available Manufacturers:
   a. Aeroquip Corporation.
   b. Bowes Manufacturing, Inc.
   c. Foster Manufacturing Co., Inc.
   d. Milton Industries, Inc.
   e. Parker Hannifin Corporation; Fluid Connectors Group; Quick Coupling Div.
   f. Rectus Corp.
   g. Schrader-Bridgeport; Amflo Div.
   h. Schrader-Bridgeport/Standard Thomson.
   i. Snap-Tite, Inc.
   j. TOMCO Products Inc.
   k. Tuthill Corporation; Hansen Coupling Div.
2. Automatic-Shutoff Quick Couplings: Straight-through brass body with O-ring or gasket seal and stainless steel or nickel-plated steel operating parts.
   a. Socket End: With one-way valve and threaded inlet for connection to piping or threaded hose fitting.
   b. Plug End: Flow-sensor-bleeder, check-valve type with serrated outlet for attaching hose.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Install nipples, flanges, unions, transition and special fittings and valves with pressure ratings same as or higher than system pressure rating used in applications below, unless otherwise

indicated.

B. Joining of Dissimilar Metal Piping: Use dielectric fittings. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for dielectric fitting types.

1. NPS 2 and Smaller: Dielectric unions.

C. Specialty and Equipment Flanged Connections: Use cast-copper-alloy companion flange with gasket and brazed joint for connection to copper tube.

D. Low-Pressure Compressed-Air Distribution Piping: Use the following piping materials for each size range:

1. NPS 2 and Smaller: Schedule 40, black-steel pipe, threaded malleable-iron fittings and threaded joints.

3.2 VALVE APPLICATIONS

A. General-Duty Valves: Refer to Division 15 Section "Valves" for metal general-duty valves. Use metal valves unless otherwise indicated.

1. Metal General-Duty Valves: Use valve types specified in "Valve Applications" Article in Division 15 Section "Valves" according to the following:
   a. Low-Pressure Compressed Air: Valve types specified for low-pressure compressed air.

3.3 PIPING INSTALLATION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.

B. Install air and drain piping with 1 percent slope downward in direction of airflow.

C. Install eccentric reducers where piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.

D. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.

E. Install flexible pipe connector on each connection to air compressors.

F. Install pressure gauge on discharge piping from each air compressor and on each receiver; install according to Division 15 Section "Meters and Gauges."

3.4 VALVE INSTALLATION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping and valve installation.

B. Install metal general-duty valves according to Division 15 Section "Valves."

C. Install shutoff valve at each connection to and from general-service compressed-air specialties, equipment and accessories. Install strainer if indicated.

D. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.

E. Install automatic drain valves on intercoolers, aftercoolers and receivers. Discharge condensate over nearest floor drain.

F. Install safety valves where recommended by specialty manufacturers.

3.5 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Pressure-Seal Joints: Select correct type of O-ring seals. Make joints with fitting manufacturer's tools and according to fitting manufacturer's written instructions.

C. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

3.6 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:
   a. 100 Feet and Less: MSS Type 1, adjustable steel clevis hangers.

B. Install supports according to Division 15 Section "Hangers and Supports."

C. Support horizontal piping within 12" of each fitting and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8" minimum rods.

F. Install hangers for Schedule 40 steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1/4 to NPS 1/2: 96" with 3/8" rod.
2. NPS 3/4 to NPS 1-1/4: 84" with 3/8" rod.
3. NPS 1-1/2: 12 feet with 3/8" rod.
4. NPS 2: 13 feet with 3/8" rod.

G. Install supports for vertical, Schedule 40 steel piping every 15 feet.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings and specialties.

B. Install piping adjacent to specialties and equipment to allow service and maintenance.

C. Connect piping to air compressors, accessories and specialties with shutoff valve and union or flanged connection.

3.8 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Test and adjust piping safety controls. Replace damaged and malfunctioning safety controls.
2. Piping Leak Tests: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig above system operating pressure, but not less than 150 psig. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
   a. Repair leaks and retest until no leaks exist.
3. Report results in writing.

END OF SECTION 15211

SECTION 15251 - GENERAL-SERVICE COMPRESSED-AIR EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following general-service compressed-air equipment and related accessories:

1. Air compressors and receivers.
2. Compressed-air filter assemblies.

B. Related Sections include the following:

1. Division 15 Section "General-Service Compressed-Air Piping" for compressed-air piping, valves and related specialties.

1.3 DEFINITIONS

A. Actual Air: Air delivered from air compressors. Flow rate is delivered compressed air measured in acfm.

B. Standard Air: Free air at 68° F and 1 atmosphere before compression or expansion and measured in scfm.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties and accessories for the following compressed-air equipment:

1. Air compressors including receivers and intake filters.
2. Compressed-air filter assemblies.

B. Shop Drawings:

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components and location and size of each field connection.
2. Wiring Diagrams: Power, signal and control wiring.

C. Product Certificates: Certificates of shop inspection and data report for receiver tanks as required by ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. Qualification Data: For Installer.

E. Startup service reports.

F. Operation and Maintenance Data: For the following compressed-air equipment and accessories to include in emergency, operation and maintenance manuals:

1. Air compressors.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of compressed-air equipment manufacturer for both installation and maintenance of units required for this project.

B. Product Options: Drawings indicate size, profiles and dimensional requirements of compressed-air equipment and are based on the specific system indicated.

C. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

D. ASME Compliance: Fabricate and label receiver tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

E. Comply with NFPA 70, "National Electrical Code."

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for concrete bases.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the manufacturers specified.

2.2 PACKAGED AIR COMPRESSORS AND RECEIVERS

A. Description: Factory-assembled, -wired, -piped and -tested, electric-motor-driven, air-cooled continuous-duty air compressors and receivers that deliver air of quality equal to intake air.

B. Control Panels: Automatic control station with load control and protection functions. Comply with NEMA ICS 2 and UL 508.

1. Mounting and Wiring: Factory installed and connected as an integral part of equipment package.
2. Enclosure: NEMA ICS 6, Type 12 control panel, unless otherwise indicated.
3. Motor Controllers: Full-voltage, combination-magnetic type with undervoltage release feature and motor-circuit-protector-type disconnecting means and short-circuit protective device.
   a. Control Voltage: 120-V ac or less, using integral control power transformer.

b. Motor Overload Protection: Overload relay in each phase.
c. Starting Devices: Hand-off-automatic selector switch in cover of control panel, plus pilot device for automatic control.

4. Instrumentation: Include receiver pressure gauge, discharge-air pressure gauge, air-filter maintenance indicator, hour meter, compressor discharge-air and coolant temperature gauges and control transformer.
5. Alarm Signal Device: For connection to alarm system to indicate when backup air compressor is operating.

C. Motors:

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

D. Receivers: Steel tank constructed according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, rated for working pressure at least as high as highest discharge pressure of connected compressors and bearing appropriate code symbols. Include safety valve, pressure gauge, automatic drain and pressure-reducing valve.

E. Fabricate base and attachment to pressure vessel with reinforcement strong enough to resist packaged equipment movement during a seismic event when base is anchored to building structure.

2.3 RECIPROCATING AIR COMPRESSORS

A. Lubricated Reciprocating Air Compressors: Simplex unit.

1. Available Manufacturers:
   a. Atlas Copco Compressors, Inc.
   b. CompAir, Ltd.
   c. Curtis-Toledo, Inc.
   d. Gardner Denver, Inc.
   e. General Air Products, Inc.
   f. Ingersoll-Rand Company; Air Compressor Group.
   g. Kaeser Compressors, Inc.
   h. Powerex.
   i. Quincy Compressor.
   j. Saylor-Beall Manufacturing Company.
2. Compressors: Single- or two-stage, lubricated, reciprocating-piston type with lubricated compression chamber and crankcase.
   a. Mounting: Tank mounted.
   b. Number of Compressors: One.
   c. Discharge Air Pressure: 150 psig.
   d. Combined high discharge-air temperature and low lubrication-oil pressure switch, submerged gear-type oil pump and oil filter.
   e. Belt guards totally enclosing pulleys and belts.
   f. Intercoolers between stages of two-stage units.
3. Receiver: ASME construction steel tank.
   a. Orientation: Horizontal arrangement.
   b. Pressure Rating: 200 psig minimum.
4. Miscellaneous Devices: Safety valves, discharge-air pressure gauges, pressure regulators and shutoff valves.

2.4 ACCESSORIES

A. General: Include accessories with working-pressure rating not less than system pressure at location where used and compatible with equipment and piping system used.

B. Separators: Conical-shaped, centrifugal air-line separator of capacity not less than connected equipment. Equip with water-removal trap and drain. Size units for maximum pressure drop through units of 3 psig from air inlet to outlet.

2.5 SPECIALTIES

A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, construction;,National Board certified, labeled and factory sealed, constructed of bronze body with poppet safety valve for compressed-air service.

1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.

B. Automatic Drain Valves: Mechanical-operation type with corrosion-resistant metal body and internal parts, rated for 200 psig minimum working pressure, capable of automatic discharge of collected condensate.

C. Pressure Regulators: Bronze body, direct acting, spring loaded, manual pressure-setting adjustment and rated for 250 psig inlet pressure, unless otherwise indicated.

1. Type: Diaphragm or pilot operated.

D. Compressed-Air Filters:

1. Available Manufacturers:
   a. Arrow Pneumatics, Inc.
   b. Dollinger.
   c. Flair Corp.
   d. Ingersoll-Rand Company; Air Compressor Group.
   e. Kaeser Compressors, Inc.
   f. Pioneer Air Systems, Inc.
   g. Ultrafilter Inc.
   h. Van Air Systems, Inc.
   i. Wilkerson Corp.
   j. ZANDER Filter Systems, Inc.
   k. Zeks Air Drier Corporation.
2. Coalescing Filters: Capacity not less than that of connected equipment, with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded. Equip with activated carbon capable of removing water and oil aerosols.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Vibration Isolation: Install ISOMOD pads 3/4" thick under legs.

B. Maintain manufacturer's recommended clearances for service and maintenance.

C. Install the following devices on compressed-air equipment:

1. Pressure Gauge and Safety Valve: Install on each compressed-air receiver.
2. Pressure Regulators: Install downstream from air compressors, dryers, purification units and filter assemblies.
3. Automatic Drain Valves: Install on intercoolers and receivers. Discharge condensate over nearest floor drain.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect piping to air compressors and receivers, except safety relief valve connections, with flexible pipe connectors of materials suitable for service. Flexible pipe connectors and their installation are specified in Division 15 Section "General-Service Compressed-Air Piping."

D. Ground equipment according to Division 16.

E. Connect wiring according to Division 16.

F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to test, inspect,and adjust components and equipment installation and to perform startup service.

B. Perform the following final checks:

1. Verify that specified tests of piping systems are complete.
2. Verify that potable-water supply connections to equipment have correct backflow preventer.
3. Check for piping connection leaks.
4. Check for lubricating oil in lubricated-type equipment.
5. Check belt drives for proper tension.
6. Verify that air-compressor inlet filters and piping are clear.
7. Check for equipment vibration-control supports and flexible pipe connectors and verify that equipment is properly attached to substrate.
8. Check safety valves for correct settings. Ensure that settings are greater than air-compressor discharge pressure but not greater than rating of system components.
9. Check for proper seismic restraints.
10. Test operation of equipment safety controls and devices.
11. Drain receiver tanks.

C. Verify that compressed-air equipment is installed and connected according to the Contract Documents.

D. Verify that electrical wiring installation complies with manufacturer's submittal and written installation requirements in Division 16 Sections.

E. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

F. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

G. Complete installation and startup checks according to manufacturer's written instructions.

H. Prepare written report documenting testing procedures and results.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain general-service compressed-air equipment.

END OF SECTION 15251

SECTION 15430 - PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following plumbing specialties:

1. Backflow preventers.
2. Water regulators.
3. Balancing valves.
4. Strainers.
5. Trap seal primer valves.
6. Drain valves.
7. Miscellaneous piping specialties.
8. Flashing materials.
9. Cleanouts.
10. Floor drains.

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following the minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Piping: 125 psig.
2. Sanitary Waste and Vent Piping: 10-foot head of water.

1.4 SUBMITTALS

A. Product Data: Include rated capacities and shipping, installed and operating weights. Indicate materials, finishes, dimensions, required clearances and methods of assembly of components and piping and wiring connections for the following:

1. Backflow preventers and water regulators.
2. Balancing valves and strainers.
3. Water hammer arresters, air vents and trap seal primer valves.
4. Drain valves.
5. Cleanouts and floor drains.
6. Vent caps, vent terminals and roof flashing assemblies.

B. Field test reports.

C. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:

1. Backflow preventers and water regulators.
2. Trap seal primer valves.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Plumbing specialties shall bear label, stamp or other markings of specified testing agency.

C. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.

E. NSF Compliance:

1. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to, the products specified.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the manufacturers specified.

2.2 BACKFLOW PREVENTERS

A. Available Manufacturers:

1. Ames Co., Inc.
2. B & K Industries, Inc.
3. Cla-Val Co.
4. CMB Industries, Inc.; Febco Backflow Preventers.
5. Conbraco Industries, Inc.
6. FLOMATIC Corp.
7. IMI Cash Valve.
8. Mueller Co.; Hersey Meters Div.
9. Sparco, Inc.
10. Watts Industries, Inc.; Water Products Div.
11. Zurn Industries, Inc.; Wilkins Div.

B. General: ASSE standard backflow preventers.

1. NPS 2 and Smaller: Bronze body with threaded ends.
2. NPS 2-1/2 and Larger: Bronze, cast-iron, steel or stainless steel body with flanged ends.

a. Interior Lining: AWWA C550 or FDA-approved, epoxy coating for backflow preventers having cast-iron or steel body.
3. Interior Components: Corrosion-resistant materials.
4. Exterior Finish: Polished chrome-plate if used in chrome-plated piping system.
5. Strainer: On inlet, if indicated.

C. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, strainer on inlet, test cocks and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves.

1. Pressure Loss: 12 psig maximum through middle 1/3 of flow range.

D. Double-Check Backflow Prevention Assemblies: ASSE 1015, suitable for continuous pressure application. Include shutoff valves on inlet and outlet, strainer on inlet, test cocks and two positive-seating check valves.

1. Pressure Loss: 5 psig maximum through middle 1/3 of flow range.

2.3 WATER REGULATORS

A. Available Manufacturers:

1. Armstrong-Yoshitake, Inc.
2. BERMAD.
3. Cashco, Inc.
4. Cla-Val Co.
5. Conbraco Industries, Inc.
6. FLOMATIC Corp.
7. G A Industries, Inc.
8. Honeywell Braukmann.
9. IMI Cash Valve.
10. Watts Industries, Inc.; Water Products Div.
11. Zurn Industries, Inc.; Wilkins Div.

B. General: ASSE 1003 water regulators rated for initial working pressure of 150 psig minimum. Include integral factory-installed or separate field-installed Y-pattern strainer.

1. NPS 2 and Smaller: Bronze body with threaded ends.
   a. General-Duty Service: Single-seated, direct operated, unless otherwise indicated.
   b. Booster Heater Water Supply: Single-seated, direct operated with integral bypass.
2. NPS 2-1/2 and Larger: Bronze or cast-iron body with flanged ends. Include AWWA C550 or FDA-approved interior epoxy coating for regulators with cast-iron body.
   a. Type: Pilot-operated, single- or double-seated, cast-iron-body main valve with bronze-body pilot valve.
3. Interior Components: Corrosion-resistant materials.
4. Exterior Finish: Polished chrome-plate if used in chrome-plated piping system.

2.4 STRAINERS

A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless steel screens with 3/64" round perforations, unless otherwise indicated.

1. Pressure Rating: 125 psig minimum steam working pressure, unless otherwise indicated.
2. NPS 2 and Smaller: Bronze body with female threaded ends.
3. Y-Pattern Strainers: Screwed screen retainer with centered blowdown.
    a. Drain: Pipe plug.

2.5 TRAP SEAL PRIMER VALVES

A. Supply-Type Trap Seal Primer Valves: ASSE 1018, water-supply-fed type with the following characteristics:

1. Available Manufacturers:
    a. E & S Valves.
    b. Josam Co.
    c. MIFAB Manufacturing, Inc.
    d. Precision Plumbing Products, Inc.
    e. Smith, Jay R. Mfg. Co.
    f. Tyler Pipe; Wade Div.
    g. Watts Industries, Inc.; Drainage Products Div.
    h. Watts Industries, Inc.; Water Products Div.
    i. Zurn Industries, Inc.; Jonespec Div.
    j. Zurn Industries, Inc.; Specification Drainage Operation.
2. 125 psig minimum working pressure.
3. Bronze body with atmospheric-vented drain chamber.
4. Inlet and Outlet Connections: NPS 1/2 threaded, union or solder joint.
5. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
6. Finish: Chrome-plated or rough bronze for units used with pipe or tube that is not chrome finished.

2.6 DRAIN VALVES

A. Hose-End Drain Valves: MSS SP-110, NPS 3/4 ball valve, rated for 400 psig minimum CWP. Include two-piece copper-alloy body with standard port chrome-plated brass ball, replaceable seats and seals, blowout-proof stem and vinyl-covered steel handle.

1. Inlet: Threaded or solder joint.

2.7 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, metal-bellows type with pressurized metal cushioning chamber. Sizes indicated are based on ASSE 1010 or PDI-WH 201, Sizes A through F.

1. Available Manufacturers:
    a. Josam Co.
    b. Smith, Jay R. Mfg. Co.
    c. Tyler Pipe; Wade Div.
    d. Zurn Industries, Inc.; Specification Drainage Operation.

B. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, piston type with pressurized metal-tube cushioning chamber. Sizes indicated are based on ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

1. Available Manufacturers:

a. Amtrol, Inc.
b. Josam Co.
c. Precision Plumbing Products, Inc.
d. Sioux Chief Manufacturing Co., Inc.
e. Watts Industries, Inc.; Drainage Products Div.
f. Watts Industries, Inc.; Water Products Div.
g. Zurn Industries, Inc.; Wilkins Div.

C. Roof Flashing Assemblies: Manufactured assembly made of 6-lb/sq. ft., 0.0938" thick lead flashing collar and skirt extending at least 10" from pipe with galvanized steel boot reinforcement and counterflashing fitting.

1. Available Manufacturers:
   a. Acorn Engineering Company; Elmdor/Stoneman Div.
2. Open-Top Vent Cap: Without cap.

D. Stack Flashing Fittings: Counterflashing-type cast-iron fitting with bottom recess for terminating roof membrane and with threaded or hub top for extending vent pipe.

E. Vent Terminals: Commercially manufactured, shop- or field-fabricated, frost-proof assembly constructed of galvanized steel, copper or lead-coated copper. Size to provide 1" enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

2.8 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4-lb/sq. ft., 0.0625" thickness.
2. Vent Pipe Flashing: 3-lb/sq. ft., 0.0469" thickness.
3. Burning: 6-lb/sq. ft., 0.0938" thickness.

B. Copper Sheet: ASTM B 152, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft.
2. Vent Pipe Flashing: 8 oz./sq. ft.

C. Zinc-Coated Steel Sheet: ASTM A 653, with 0.20 percent copper content and 0.04" minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices and similar accessory units required for installation, matching or compatible with material being installed.

F. Solder: ASTM B 32, lead-free alloy.

G. Bituminous Coating: SSPC-Paint 12, solvent-type bituminous mastic.

2.9 CLEANOUTS

A. Cleanouts: Comply with ASME A112.36.2M.

1. Application: Floor or wall cleanout for installation in exposed piping.
2. Available Products:
    a. Josam Co.
    b. Josam Co., Blucher-Josam Div.
    c. LSP Products Group.
    d. Sioux Chief Manufacturing Co., Inc.
    e. Smith, Jay R. Mfg. Co.
    f. Tyler Pipe, Wade Div.
    g. Watts Industries, Inc., Drainage Products Div.
    h. Zurn Industries, Inc., Jonespec Div.
    i. Zurn Industries, Inc., Specification Drainage Operation.
3. Body or Ferrule Material: Cast-iron.
4. Clamping Device: Required.
5. Outlet Connection: Threaded. Inside caulk.
6. Closure: Brass plug with tapered threads.
7. Adjustable Housing Material: Cast-iron with threads.
8. Frame and Cover Material and Finish: Polished bronze.
9. Frame and Cover Shape: Round.
10. Top Loading Classification: Light duty.

2.10 FLOOR DRAINS

A. Floor Drains:

1. Application: Floor drain.
2. Available Products:
    a. Josam Co.
    b. Josam Co., Blucher-Josam Div.
    c. Sioux Chief Manufacturing Co., Inc.
    d. Smith, Jay R. Mfg. Co.
    e. Tyler Pipe, Wade Div.
    f. Watts Industries, Inc., Drainage Products Div.
    g. Zurn Industries, Inc., Jonespec Div.
    h. Zurn Industries, Inc., Specification Drainage Operation.
3. Body Material: Gray iron.
4. Seepage Flange: Required. Anchor flange.
5. Clamping Device: Required.
6. Outlet: Bottom or side.
7. Top or Strainer Material: Bronze.
8. Top of Body and Strainer Finish: Polished bronze.
9. Top Shape: Round.
11. Top Loading Classification: Light duty.
12. Trap Material: Cast-iron.
13. Trap Pattern: Standard P-trap.
14. Trap Features: Trap seal primer valve drain connection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gauges on inlet and outlet.

D. Install strainers on supply side of each control valve, pressure regulator and solenoid valve.

E. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap or inlet fitting. Adjust valve for proper flow.

F. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

G. Install cleanout deckplates with top flush with finished floor for floor cleanouts for piping below floors.

H. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall for cleanouts located in concealed piping.

I. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

J. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

K. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. **NOTE: Installation must meet ADA.**
2. Position floor drains for easy access and maintenance and in accordance with ADA.
3. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
   a. Radius, 30" or Less: Equivalent to 1 percent slope but not less than 1/4" total depression.
   b. Radius, 30" to 60": Equivalent to 1 percent slope.
   c. Radius, 60" or Larger: Equivalent to 1 percent slope, but not greater than 1" total depression.
4. Install floor-drain flashing collar or flange so no leakage occurs between drain and

adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

L. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

M. Fasten recessed-type plumbing specialties to reinforcement built into walls.

N. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.

O. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 15 Section "Valves" for general-duty ball, butterfly, check, gate and globe valves.

P. Install air vents at piping high points. Include ball, gate or globe valve in inlet and drain piping from outlet to floor drain.

Q. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

R. Install escutcheons at wall, floor and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect plumbing specialties to piping specified in other Division 15 Sections.

D. Ground equipment.

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in U 486A and UL 486B.

F. Connect plumbing specialties and devices that require power according to Division 16 Sections.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6-lb/sq. ft., 0.0938" thickness or thicker. Solder joints of lead sheets 4-lb/sq. ft., 0.0625" thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves and specialties passing through or embedded in floors

and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10" and skirt or flange extending at least 8" around pipe.
2. Sleeve Flashing: Flat sheet with skirt or flange extending at least 8" around sleeve.
3. Embedded Specialty Flashing: Flat sheet with skirt or flange extending at least 8" around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings according to Division 7 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps and other drainage shapes.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 15430

SECTION 15440 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Requirements of the following Division 15 Sections apply to this Section:

1. Basic Mechanical Materials and Methods.

1.2 SUMMARY

A. This Section includes plumbing fixtures and trim, fittings and accessories, appliances, appurtenances, equipment and supports associated with plumbing fixtures.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 15 Section "Valves" for valves used as supply stops.

C. Products furnished but not installed under this Section include:

1. Plumbing fittings (including faucets) and piping indicated for fixtures, appliances, appurtenances and equipment provided by Owner.
2. Plumbing fittings (including faucets) and piping indicated for fixtures, appliances, appurtenances and equipment specified in other sections.

D. Products installed but not furnished under this Section include:

1. Owner-supplied fixtures, as indicated.
2. Accessories, appliances, appurtenances and equipment specified in other sections requiring plumbing services or fixture-related devices, as indicated.

1.3 DEFINITIONS

A. Accessible: Describes a plumbing fixture, building, facility or portion thereof that can be approached, entered and used by physically handicapped people.

B. Accessory: Device that adds effectiveness, convenience or improved appearance to a fixture but is not essential to its operation.

C. Appliance: Device or machine designed and intended to perform a specific function.

D. Appurtenance: Device or assembly designed to perform some useful function when attached to or used with a fixture.

E. Equipment: Device used with plumbing fixtures or plumbing systems to perform a certain function for plumbing fixtures but that is not part of the fixture.

F. Fitting: Fitting installed on or attached to a fixture to control the flow of water into or out of the fixture.

G. Fixture: Installed receptor connected to the water distribution system that receives and makes available potable water and discharges the used liquid or liquid-borne wastes directly or indirectly into the drainage system. The term "Fixture" means the actual receptor except when used in a general application where terms "Fixture" and "Plumbing Fixture" include associated trim, fittings, accessories, appliances, appurtenances, support and equipment.

H. Roughing-In: Installation of piping and support for the fixture prior to the actual installation of the fixture.

I. Support: Device normally concealed in building construction for supporting and securing plumbing fixtures to walls and structural members. Supports for urinals, lavatories and sinks are made in types suitable for fixture construction and the mounting required. Categories of supports are:

1. Carrier: Floor-mounted support for wall-mounted water closet and support fixed to wall construction for wall-hung fixture.
2. Chair Carrier: Support for wall-hung fixture having steel pipe uprights that transfer weight to the floor.
3. Chair Carrier, Heavy Duty: Support for wall-hung fixture having rectangular steel uprights that transfer weight to the floor.
4. Reinforcement: Wood blocking or steel plate built into wall construction for securing fixture to wall.

J. Trim: Hardware and miscellaneous parts specific to a fixture and normally supplied with it required to complete fixture assembly and installation.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

1. Product data for each type of plumbing fixture specified including fixture and trim, fittings, accessories, appliances, appurtenances, equipment, supports, construction details, dimensions of components and finishes.
2. Wiring diagrams for field-installed wiring of electrically-operated units.

1.5 QUALITY ASSURANCE

A. ADA Requirements: Comply with requirements of Americans with Disability Act. Provide fixtures complying with ADA accessibility requirements.

B. Regulatory Requirements: Comply with requirements of ANSI Standard A117.1 "Buildings and Facilities -- Providing Accessibility and Useability for Physically Handicapped People" and Public Law 90-480 "Architectural Barriers Act, 1968" with respect to plumbing fixtures for the physically handicapped.

C. Regulatory Requirements: Comply with requirements of ATBCB (Architectural and Transportation Barriers Compliance Board) "Uniform Federal Accessibility Standards (UFAS) - 1985-494-187" with respect to plumbing fixtures for the physically handicapped.

D. Listing and Labeling: Provide electrically-operated fixtures specified in this Section that are listed and labeled.

1. The terms "listed" and "labeled" shall be as defined in the National Electrical Code, Article

100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

E. Design Concept: The drawings indicate types of plumbing fixtures and are based on the specific descriptions, manufacturers, models and numbers indicated. Plumbing fixtures having equal performance characteristics by other manufacturers may be considered provided that deviations in dimensions, operation, color or finish or other characteristics are minor and do not change the design concept or intended performance as judged by the Architect. Burden of proof for equality of plumbing fixtures is on the proposer.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver plumbing fixtures in manufacturer's protective packing, crating and covering.

B. Store plumbing fixtures on elevated platforms in a dry location.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

A. Manufacturers: Subject to compliance with requirements, provide products in each category by one of the following listed for that category:

1. Water Closets:
   a. American Standard, Inc.
   b. Barclay Products Ltd.
   c. Briggs Div.; Briggs Industries, Inc.
   d. Crane Plumbing/Fiat Products.
   e. Eljer; A Household International Co.
   f. Gerber Plumbing Fixture Corp.
   g. Kohler Co.
   h. Mansfield Plumbing Products, Inc.
   I. Microphor, Inc.
   j. Universal-Rundle Corp.
   k. Water Control International, Inc.

2. Urinals:
   a. American Standard, Inc.
   b. Briggs Div.; Briggs Industries, Inc.
   c. Crane Plumbing/Fiat Products.
   d. Eljer; A Household International Co.
   e. Gerber Plumbing Fixture Corp.
   f. Kohler Co.
   g. Mansfield Plumbing Products, Inc.
   h. Universal-Rundle Corp.
   I. Urinette, Inc.

3. Lavatories:
   a. Acorn Engineering Co.

b. American Standard, Inc.
c. Barclay Products Ltd.
d. Briggs Div.; Briggs Industries, Inc.
e. Crane Plumbing/Fiat Products.
f. Eljer; A Household International Co.
g. Gerber Plumbing Fixture Corp.
h. International Sanitary Ware Manufacturing Co.
I. Just Manufacturing Co.
j. Kohler Co.
k. Mansfield Plumbing Products, Inc.
l. Universal-Rundle Corp.

4. Sinks:
   a. American Standard, Inc.
   b. Briggs Div.; Briggs Industries, Inc.
   c. Crane Plumbing/Fiat Products.
   d. Eljer; A Household International Co.
   e. Elkay Manufacturing Co.
   f. Just Manufacturing Co.
   g. Kohler Co.
   h. Moen Group; Stanadyne Corp.
   I. Universal-Rundle Corp.

5. Showers:
   a. Acorn Engineering Co.
   b. American Standard, Inc.
   c. Aqua Glass Corp.
   d. Aquarius Div.; Briggs Industries, Inc.
   e. Bradley Corp.
   f. Crane Plumbing/Fiat Products.
   g. Eljer; A Household International Co.
   h. Encon.
   I. Fiberglass Systems.
   j. Kohler Co.
   k. Swan Corp.
   l. Universal-Rundle Corp.

6. Water Coolers:
   a. EBCO Manufacturing Co.
   b. Elkay Manufacturing Co.
   c. Filtrine Manufacturing Co.
   d. Halsey Taylor; A Household International Co.
   e. Haws Drinking Faucet Co.
   f. Sunroc Corp.
   g. Western Drinking Fountains; Sunroc Corp.

7. Water Heaters:
   a. American.
   b. Bradford White.
   c. Lochinvar.
   d. PVI.
   e. Reco.
   f. Rheem.
   g. A.O. Smith.

h. State.
I. Weben-Jarco.

8. Toilet Seats:
   a. Bemis Mfg. Co.
   b. Beneke Div.; Sanderson Plumbing Products, Inc.
   c. Church Seat Co.
   d. Kohler Co.
   e. Olsonite Corp.
   f. Sperzel Industries, Inc.

9. Commercial/Industrial Cast-Brass Faucets:
   a. American Standard, Inc.
   b. Briggs Div.; Briggs Industries, Inc.
   c. Chicago Faucet Co.
   d. Crane Plumbing/Fiat Products.
   e. Delta Faucet Co.; Div. of Masco Corp.
   f. Eljer; A Household International Co.
   g. Fisher Manufacturing Co.
   h. Grohe America, Inc.
   I. Kohler Co.
   j. Royal Brass Mfg. Co.
   k. Speakman Co.
   l. Symmons Industries, Inc.
   m. T & S Brass and Bronze Works, Inc.

10. Pressure Balance Bath/Shower Faucets:
   a. American Standard, Inc.
   b. Bradley Corp.
   c. Chicago Faucet Co.
   d. Crane Plumbing/Fiat Products.
   e. Delta Faucet Co.; Div. of Masco Corp.
   f. Eljer; A Household International Co.
   g. Elkay Manufacturing Co.
   h. Grohe America, Inc.
   I. Kohler Co.
   j. Lawler Manufacturing Co., Inc.
   k. Leonard Valve Co.
   l. Moen Group; Stanadyne Corp.
   m. Nibco, Inc.
   n. Powers Process Controls; A Unit of Mark Controls Corp.
   o. Price Pfister, Inc.
   p. Royal Brass Mfg. Co.
   q. Speakman Co.
   r. Symmons Industries, Inc.
   s. Valley Faucets Div.; U.S. Brass.

11. Shower Receptors:
   a. Aqua Glass Corp.
   b. Crane Plumbing/Fiat Products.
   c. Florestone Products Co., Inc.
   d. Lyons Industries, Inc.
   e. Stern-Williams Co., Inc.
   f. Swan Corp.

12. Miscellaneous Fittings (Except Faucets):
    a. Aquaflo Corp.
    b. Beaton & Corbin Mfg. Co.
    c. Brass Craft Subsidiary; Masco Co.
    d. Bridgeport Plumbing Products, Inc.
    e. Central Brass Manufacturing Co.
    f. Chicago Faucet Co.
    g. Connecticut Stamping & Bending Co.
    h. Crane Plumbing/Fiat Products.
    I. Eljer; A Household International Co.
    j. Engineered Brass Co.
    k. Kohler Co.
    l. McGuire Manufacturing Co., Inc.
    m. Price Pfister, Inc.
    n. Royal Brass Mfg. Co.
    o. Sanitary-Dash Manufacturing Co., Inc.
    p. T & S Brass and Bronze Works, Inc.
    q. Teledyne Ansonia.
    r. Zurn Industries, Inc.; Hydromechanics Div.

13. Supports:
    a. Ancon, Inc.
    b. Josam Co.
    c. Smith (Jay R.) Mfg. Co.
    d. Wade Div.; Tyler Pipe.
    e. Zurn Industries, Inc.; Hydromechanics Div.

2.2 PLUMBING FIXTURES, GENERAL

A. Provide plumbing fixtures and trim, fittings, other components and supports as specified.

B. P-1 Water Closet (Pressure Flush Tank/Handicapped): Kohler K-3422, 18" high bowl with K-4670-C seat and bolt caps, 1.6 gallons per flush. Install with angle stop. Fixture color: White.

C. P-2 Lavatory (Handicapped): Kohler K-2032, 20"x18" with Delta 501 WFHGMHDF single-lever faucet with .5 gpm vandal-resistant aerator, grid strainer, tailpiece, offset wheelchair trap, loose key stops. Provide Jay R. Smith 0700 carrier; coordinate with wall type. Provide Truebro Inc. Model 102 closed-cell vinyl handicapped insulation kit with Model 105 offset tailpiece accessory, fasteners for trap and hot and cold water angle stop valves.

D. P-3 Urinal: Kohler K-4972-T with Sloan Regal 180-1-YB, 1.0 gallon flush valve. Secure piping in wall serving flush valve. Provide Jay R. Smith 0637 carrier.

E. P-4 Shower Stall: Fiberglass Systems Inc CS-3636, 36"x36" nominal shower. Provide pressure balance single-lever mixing valve with integral stops. Provide drain, soap dish, curtain rod and curtain. Coordinate rough-in opening size with General Contractor prior to work commencing. Mechanical Contractor to verify if right-hand or left-hand shower is required.

F. P-5 Floor Drain: Jay R. Smith No. 2005-A05-PB with polished-bronze strainer, trap and primer. Locate primer with shutoff valve and access panel in wall. Coordinate with General Contractor.

G. P-6 Breakroom Sink: Elkay LR-1716, 18 gauge Type 302 stainless steel self-rimming sink with LK-35 basket strainer. Provide trap, tailpiece and angle stops. Provide LKC-2223 swivel gooseneck faucet.

H. P-7 Water Cooler: Haws HWBFA8 water cooler, 120 volts, 244 watts, 8 GPH, lead free. Provide with Jay R. Smith 0834 carrier.

I. P-8 Sand and Grease Trap: Provide Boise Vault 1000 gallon grease interceptor with HS-25 traffic loading or equivalent. Overall dimensions are 102" long x 59" wide x 67" deep.

J. P-9 Floor Sink (3”): Jay R. Smith SW-3-1187-90 with full grate and dome strainer. Locate primer with shutoff valve and access panel in wall. Coordinate with General Contractor.

K. P-10 Hose Bibb (Outdoor): Woodford Model 65, auto-draining with vacuum breaker, loose key stops and barrel length to suit wall construction.

L. P-11 Hose Bibb (Indoor): Woodford Model 24P with tee key and vacuum breaker. Provide chrome-plated finish over cast-brass.

M. P-12 Air Outlet: Reference Detail A on Sheet P1 for air outlet detail.

N. P-13 Water Heater: A.O. Smith GPDX-75, 75 gallon glass-lined LP gas-fired storage tank with AGA approval, 65 MBH input 67 GPH at 90° F temperature rise. Provide ASME T&P relief valve. Foam insulation per ASHRAE standard, AGA certified gas pressure regulator, anode rod, integral gas shutoff valve, temperature regulated.

O. P-14 Ice Maker (By Others): Plumbing Contractor to install ice maker supplied by ITD. Provide a 1/2" cold water supply line with accessible ball valve shutoff. Coordinate backflow prevention requirements with equipment manufacturer and plumbing inspector. Provide indirect waste from ice machine drain to floor sink below.

P. P-15 Floor Drain with Sediment Bucket: Jay R. Smith No. 2005-A08-PB-B-G-H with polished bronze strainer, sediment bucket, hinged grate, optional low-dome strainer, trap primer and stop valve. Locate primer with shutoff valve and access panel in wall. Coordinate with General Contractor.

2.3 FITTINGS, EXCEPT FAUCETS

A. Fittings, General: Unless otherwise specified, provide fittings fabricated of brass with a polished chrome-plated finish.

B. Lavatory Supplies and Stops: Loose-key angle stop having 1/2" NPS inlet with wall flange and 3/8" by 12" flexible tubing riser outlet.

C. Lavatory Traps: Cast-brass, 1-1/4" NPS adjustable P-trap with cleanout, 17-gauge tubular waste to wall and wall flange.

D. Sink Supplies and Stops: Loose-key angle stop having 1/2" NPS inlet with wall flange and 1/2" by 12" flexible tubing riser outlet.

E. Sink Traps: Cast-brass, 1-1/2" NPS adjustable P-trap with cleanout, 17-gauge tubular waste to wall and wall flange.

F. Water Closet Supplies and Stops: Loose-key angle stop having 1/2" NPS inlet with wall flange and 1/2" by 12" flexible tubing riser outlet with collar.

G. Urinal Traps: 1-1/2" NPS adjustable P-trap with cleanout, 17-gauge tubular waste to wall and

wall flange.

H. Supply and drain plumbing service fittings not listed above shall be as specified and as scheduled.

I. Fittings installed concealed inside a plumbing fixture or within wall construction may be without chrome-plate finish.

J. Escutcheons: Wall flange with set screw.

K. Escutcheons: Polished chrome-plated, sheet steel wall flange with friction clips.

L. Deep Pattern Escutcheons: Wall flange with set screw or sheet-steel wall flange with friction clips, of depth adequate to conceal protruding roughing-in fittings.

M. Provide fittings specified as part of a fixture description in lieu of fitting requirements above.

2.4 TOILET SEATS

A. General: Provide toilet seats compatible with water closets of type, color and features indicated.

B. Toilet Seats: Extra heavy-duty, commercial/industrial type, elongated, open front, solid plastic, with check hinge.

2.5 PLUMBING FIXTURE SUPPORTS

A. Supports: ASME A112.6.1M, categories and types as required for wall-hanging fixtures specified and wall reinforcement.

B. Support categories are:

1. Carriers: Supports for wall-hanging water closets and fixtures supported from wall construction. Water closet carriers shall have an additional faceplate and coupling when used for wide pipe spaces. Provide tiling frame or setting gauge with carriers for wall-hanging water closets.
2. Chair Carriers: Supports with steel pipe uprights for wall-hanging fixtures. Urinal chair carriers shall have bearing plates.
3. Chair Carriers, Heavy Duty: Supports with rectangular steel uprights for wall-hanging fixtures.
4. Reinforcement: 2" by 4" wood blocking between studs or 1/4" by 6" steel plates attached to studs in wall construction to secure floor-mounted and special fixtures to wall.

C. Support Types: Provide support of category specified of type having features required to match fixture.

D. Provide supports specified as part of fixture description in lieu of category and type requirements above.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for potable cold water and hot water supplies and soil, waste and vent

piping systems to verify actual locations of piping connections prior to installing fixtures.

B. Examine walls, floors and cabinets for suitable conditions where fixtures are to be installed.

C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 APPLICATION

A. Install plumbing fixtures and specified components in accordance with designations and locations indicated on drawings.

B. Install supports for plumbing fixtures in accordance with categories indicated and of type required.

1. Carriers for following fixtures:
   a. Wall-hanging fixtures supported from wall construction.
2. Chair carriers for the following fixtures:
   a. Wall-hanging urinals.
   b. Wall-hanging lavatories and sinks.
   c. Wall-hanging drinking fountains and electric water coolers.

3.3 INSTALLATION OF PLUMBING FIXTURES

A. Install plumbing fixtures level and plumb in accordance with fixture manufacturers' written installation instructions, roughing-in drawings and referenced standards.

B. Install floor-mounted, floor-outlet water closets with closet flanges and gasket seals.

C. Install floor-mounted, back-outlet water closets with fittings and gasket seals.

D. Install wall-hanging, back-outlet water closets with support manufacturer's tiling frame or setting gauge.

E. Install wall-hanging, back-outlet urinals with gasket seals.

F. Fasten wall-hanging plumbing fixtures securely to supports attached to building substrate when supports are specified and to building wall construction where no support is indicated.

G. Fasten floor-mounted fixtures and special fixtures having holes for securing fixture to wall construction to reinforcement built into walls.

H. Fasten wall-mounted fittings to reinforcement built into walls.

I. Fasten counter-mounting-type plumbing fixtures to casework.

J. Secure supplies behind wall or within wall pipe space, providing rigid installation.

K. Set shower receptors and mop basins in leveling bed of cement grout.

L. Install stop valve in an accessible location in each water supply to each fixture.

M. Install trap on fixture outlet except for fixtures having integral trap.

N. Install escutcheons at each wall, floor and ceiling penetration in exposed finished locations and

within cabinets and millwork. Use deep pattern escutcheons where required to conceal protruding pipe fittings.

O. Seal fixtures to walls, floors and counters using a sanitary type, one-part, mildew-resistant, silicone sealant in accordance with sealing requirements specified in Division 7 Section "Joint Sealers." Match sealant color to fixture color.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other sections of Division 15. The drawings indicate general arrangement of piping, fittings and specialties. The following are specific connection requirements:

1. Install piping connections between plumbing fixtures and piping systems and plumbing equipment specified in other sections of Division 15.
2. Install piping connections indicated between appliances and equipment specified in other sections, direct connected to plumbing piping systems.

3.5 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.

3.6 ADJUSTING AND CLEANING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings and controls.

B. Operate and adjust disposers, hot water dispensers and controls. Replace damaged and malfunctioning units and controls.

C. Adjust water pressure at drinking fountains, electric water coolers, faucets, shower valves and flushometers having controls to provide proper flow and stream.

D. Replace washers of leaking and dripping faucets and stops.

E. Clean fixtures, fittings and spout and drain strainers with manufacturers' recommended cleaning methods and materials.

F. Review the data in Operating and Maintenance Manuals. Refer to Division 1 Section "Project Closeout."

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities except when approved in writing by the Owner.

END OF SECTION 15440

SECTION 15513 - CONDENSING BOILERS

PART 1 - GENERAL

1.1_ RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes packaged, factory-fabricated and -assembled, gas-fired, water-tube condensing boilers, trim and accessories for generating hot water.

1.3 SUBMITTALS

A. Product Data: Include performance data, operating characteristics, furnished specialties and accessories.

B. Shop Drawings: For boilers, boiler trim and accessories. Include plans, elevations, sections, details and attachments to other work.

1. Wiring Diagrams: Power, signal and control wiring.

C. Source quality-control test reports.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For boilers to include in emergency, operation and maintenance manuals.

F. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.

C. ASHRAE/IESNA .90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."

D. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."

E. UL Compliance: Test boilers for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Water-Tube Condensing Boilers: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. AERCO International.
2. Fulton Boiler Works, Inc.
3. Gasmaster Industries Incorporated.
4. Heat Transfer Products, Inc.
5. Hydrotherm, Inc.; a division of Mestek, Inc.
6. Laars Heating Systems; a division of Waterpik Technologies, Inc.
7. Lochinvar Corporation.

2.2 MANUFACTURED UNITS

A. Description: Factory-fabricated, -assembled and -tested water-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base, including insulated jacket, flue-gas vent, combustion-air intake connections, water supply, return and condensate drain connections and controls. Water heating service only.

B. Heat Exchanger: Finned-copper primary and stainless steel secondary heat exchangers.

C. Combustion Chamber: Stainless steel, sealed.

D. Burner: Propane gas, forced draft drawing from gas premixing valve.

E. Blower: Centrifugal fan to operate during each burner firing sequence and to prepurge and postpurge the combustion chamber.

1. Motors:
    a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

F. Gas Train: Combination gas valve with manual shutoff and pressure regulator.

G. Ignition: Silicone carbide hot-surface ignition that includes flame safety supervision and 100 percent main-valve shutoff.

H. Integral Circulator: Cast-iron body and stainless steel impeller sized for minimum flow required in heat exchanger.

I. Casing:

1. Jacket: Sheet metal, with snap-in or interlocking closures.
2. Control Compartment Enclosures: NEMA 250, Type 1A.
3. Finish: Textured epoxy.
4. Insulation: Minimum 2" thick mineral-fiber insulation surrounding the heat exchanger.
5. Combustion-Air Connections: Inlet and vent duct collars.
6. Mounting base to secure boiler.

J. Characteristics and Capacities: As listed on the drawings.

2.3 TRIM

A. Include devices sized to comply with ANSI B31.9, "Building Services Piping."

B. Controllers: Modulating input and high limit with variable fan speed.

C. Safety Relief Valve: ASME rated.

D. Pressure and Temperature Gauge: Minimum 3-1/2" diameter, combination water-pressure and -temperature gauge. Gauges shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.

E. Boiler Air Vent: Automatic.

F. Drain Valve: Minimum NPS 3/4 hose-end gate valve.

G. Circulation Pump: Non-overloading in-line pump with split-capacitor motor having thermal-overload protection and lubricated bearings; designed to operate at specified boiler pressures and temperatures.

2.4 CONTROLS

A. Refer to Section 15772 "Radiant Heating Piping" for additional control requirements.

B. Boiler operating controls shall include the following devices and features:

1. Control transformer.
2. Setpoint Adjust: Setpoints shall be adjustable.
3. Sequence of Operation: Electric, factory-fabricated and -installed panel to control burner firing rate to maintain water temperature in response to controller with sensor located in heated space and piping. Refer to Section 15772 “Radiant Heating Piping”.

C. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.

1. High Cutoff: Manual reset stops burner if operating conditions rise above maximum boiler design temperature.
2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be manual-reset type.
3. Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.

4. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.

2.5 ELECTRICAL POWER

A. Controllers, Electrical Devices and Wiring: Electrical devices and connections are specified in Division 16 Sections.

B. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers,and other electrical devices necessary shall provide a single-point field power connection to boiler.

1. House in NEMA 250, Type 1 enclosure.
2. Wiring shall be numbered and color-coded to match wiring diagram.
3. Install factory wiring outside of an enclosure in a metal raceway.
4. Field power interface shall be to fused disconnect switch.
5. Provide branch power circuit to each motor and to controls with a disconnect switch or circuit breaker.
6. Provide each motor with overcurrent protection.

2.6 VENTING KITS

A. Kit: Complete system, ASTM A 959, Type 29-4C stainless steel, pipe, vent terminal, thimble, indoor plate, vent adapter, condensate trap, dilution tank and sealant.

B. Combustion-Air Intake: Complete system, stainless steel, pipe, vent terminal with screen, inlet air coupling and sealant.

2.7 SOURCE QUALITY CONTROL

A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.

B. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations and piping and electrical connections to verify actual locations, sizes and other conditions affecting boiler performance, maintenance and operations.

1. Final boiler locations indicated on drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

A. Examine mechanical spaces for suitable conditions where boilers will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BOILER INSTALLATION

A. Install boilers level on concrete base.

B. Install gas-fired boilers according to NFPA 54.

C. Assemble and install boiler trim.

D. Install electrical devices furnished with boiler but not specified to be factory mounted.

E. Install control wiring to field-mounted electrical devices.

3.3 CONNECTIONS

F. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings and specialties.

G. Install piping adjacent to boiler to allow service and maintenance.

H. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.

I. Connect piping to boilers, except safety relief valve connections, with flexible connectors of materials suitable for service.

J. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.

K. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.

L. Install piping from safety relief valves to nearest floor drain.

M. Boiler Venting:

1. Install flue venting kit and combustion-air intake.

XIV. Ground equipment according to Division 16.

J. Connect wiring according to Division 16.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform installation and startup checks according to manufacturer's written instructions.
2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
    a. Check and adjust initial operating setpoints and high- and low-limit safety setpoints of fuel supply, water level and water temperature.
    b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Remove and replace malfunctioning units and retest as specified above.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain boilers.

END OF SECTION 15513

SECTION 15514 - FINNED WATER-TUBE BOILERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes packaged factory-fabricated and -assembled, gas-fired finned water-tube boilers, trim and accessories for generating hot water.

1.3 SUBMITTALS

A. Product Data: Include performance data, operating characteristics, furnished specialties and accessories.

B. Shop Drawings: For boilers, boiler trim and accessories. Include plans, elevations, sections, details and attachments to other work.

1. Wiring Diagrams: Detail power, signal and control wiring.

C. Source quality-control test reports.

D. Startup service reports.

E. Operation and Maintenance Data: For finned water-tube boilers to include in emergency, operation and maintenance manuals.

F. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles and dimensional requirements of finned water-tube boilers and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

C. ASME Compliance: Fabricate and label finned water-tube boilers to comply with ASME Boiler and Pressure Vessel Code: Section IV.

D. ASHRAE/IESNA 90.1 Compliance: Finned water-tube boilers shall have minimum efficiency according to Table 10-8.

E. I=B=R Compliance: Finned water-tube boilers shall be tested and rated according to HI's "Testing and Rating Standard for Heating Boilers," with I=B=R emblem on a nameplate affixed to boiler.

F. UL Compliance: Test finned water-tube boilers to comply with UL 795, "Commercial-Industrial Gas Heating Equipment."

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace heat exchangers damaged by thermal shock and vent dampers of finned water-tube boilers that fail in materials or workmanship within specified warranty period.

B. Warranty Period for Heat Exchangers: Ten years from date of Substantial Completion.

C. Warranty Period for Vent Dampers: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Ajax Boiler Inc.
2. Allied Engineering Co.
3. Harsco Corp.; Patterson-Kelley Co./a Harsco Co.
4. Lochinvar Corp.
5. PRECISION Boilers, LLC.
6. Raypak.
7. RBI Water Heaters.
8. RECO USA.
9. Smith, A. O. Water Products Co.
10. Teledyne Laars; Div. of Teledyne Ind., Inc.
11. Weben-Jarco.

2.2 PACKAGED BOILERS

A. Description: Factory-fabricated, -assembled and -tested finned water-tube boiler with tubes sealed into headers pressure-tight and set on a steel base, including insulated jacket, flue-gas vent, combustion-air intake connections, water supply and return connections and controls.

B. Fabricate base and attachment to pressure vessel with reinforcement strong enough to resist boiler movement during a seismic event when boiler base is anchored to building structure.

C. Boiler Characteristics and Capacities: As listed on drawings.

2.3 FINNED WATER-TUBE BOILER COMPONENTS

A. Heat Exchanger:

1. Finned copper tubing with stainless steel baffles.
2. Bronze or cast-iron headers.

3. Single- or two-pass horizontal configuration.
4. Tubes shall be sealed in header by welding or by mechanically rolling tubes in header.

B. Combustion Chamber Internal Insulation: Interlocking panels of refractory insulation, high-temperature cements, mineral fiber and ceramic refractory tile for service temperatures to 2000° F.

C. Casing:

1. Jacket: Stainless steel with snap-in or interlocking closures.
2. Control Compartment Enclosure: NEMA 250, Type 1A.
3. Finish: Baked enamel over primer.
4. Insulation: Minimum 2" thick fiberglass insulation surrounding the heat exchanger.
5. Draft Hood: Integral or external.
6. Combustion-Air Connection: Inlet duct collar and sheet metal closure over burner compartment.
7. Mounting base to secure boiler to concrete base.

2.4 BURNER

A. Burner Tubes and Orifices: Stainless steel for natural gas. Mount burner tubes in a slide-out burner drawer for ease of inspection.

1. Sealed Combustion: Factory-mounted centrifugal fan to draw outside air into boiler and discharge into burner compartment.
2. Direct Vent: Factory-mounted centrifugal fan to draw flue gas out of boiler and discharge into boiler vent.

B. Gas Train: Control devices and full-modulation or proportional control sequence shall comply with requirements in ASME CSD-1. In addition to these requirements, include shutoff cock, pressure regulator and control valve.

C. Gas Train: Combination gas valve with manual shutoff, pressure regulator and pilot adjustment.

D. Pilot: Intermittent-electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.

2.5 BOILER TRIM

A. Aquastat Controllers: Operating, firing rate and high limit.

B. Safety Relief Valve: ASME rated. 50 psig.

C. Altitude and Temperature Gauge: Minimum 3-1/2" diameter, combination water-pressure and -temperature gauge. Gauges shall have operating-pressure and -temperature ranges so normal operating range is at approximately 50 percent of full range.

D. Boiler Air Vent: Automatic.

E. Drain Valve: Minimum NPS 3/4 hose-end gate valve.

2.6 BURNER OPERATING CONTROLS

A. Description: To maintain safe operating conditions, burner safety controls limit the operation of burner.

1. High Cutoff: Automatic reset stops burner if operating conditions rise above maximum boiler design temperature.
2. Waterflow Switch: Automatic-reset paddle-switch shall prevent burner operation on low waterflow.
3. Blocked Vent Safety Switch: Manual-reset switch factory mounted on draft diverter.
4. Rollout Safety Switch: Factory mounted on boiler combustion chamber.
5. Alarm Bell: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.

2.7 BOILER OPERATING CONTROLS

A. Boiler operating controls shall include the following devices and features:

1. Control Transformer: 115 V.
2. Sequence of Operation: Electric, factory-fabricated and field-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 0° F outside-air temperature, set supply-water temperature at 180° F; at 60° F outside-air temperature, set supply-water temperature at 150° F.

2.8 VENTING KITS

A. Vent Damper: Motorized, 24-V ac, UL listed for use on atmospheric burner boiler equipped with draft hood, motor to open and close damper, stainless steel vent coupling and damper blade, keyed wiring harness connector plug and dual-position switches to permit burner operation.

B. Kit: Stainless steel vertical vent terminal, roof passage thimble, indoor plate, vent adapter, condensate trap and sealant.

C. Combustion-Air Intake: Stainless steel horizontal vent terminal with screen, inlet air coupling and sealant.

D. Chimney and Type PS Vent Adapter: Vent adapter and sealant.

2.9 SOURCE QUALITY CONTROL

A. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code: Section IV, for low-pressure boilers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes and other conditions affecting boiler performance, maintenance and operations.

1. Final boiler locations indicated on drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

B. Examine mechanical space for suitable conditions where boilers will be installed. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BOILER INSTALLATION

A. Install boilers level on concrete base. Concrete base is specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Concrete Bases: Anchor boilers to concrete base.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18" centers around full perimeter of base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Cast-in-place concrete materials and placement requirements are specified in Division 3.

C. Install gas-fired boilers according to NFPA 54.

D. Assemble and install boiler trim.

E. Install electrical devices furnished with boiler but not specified to be factory mounted.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings and specialties.

B. Connect gas piping full size to boiler gas-train inlet with union.

C. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.

D. Install piping from safety relief valves to nearest floor drain.

E. Connect breeching full size to boiler outlet. Refer to Division 15 Section "Breechings, Chimneys and Stacks" for venting materials.

F. Install piping adjacent to boiler to allow service and maintenance.

G. Ground equipment according to Division 16.

H. Connect wiring according to Division 16.

I. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to test, inspect and adjust boiler components and equipment installation and to perform startup service.

B. Perform installation and startup checks according to manufacturer's written instructions.

C. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.

D. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.

E. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

F. Adjust initial temperature setpoints.

G. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

H. Prepare written report that documents testing procedures and results.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain finned water-tube boilers.

END OF SECTION 15514

SECTION 15543 - FUEL-FIRED UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes LP gas-fired unit heaters.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, shipping, installed and operating weights, furnished specialties and accessories.

B. Wiring Diagrams: Power, signal and control wiring.

C. Field Quality-Control Test Reports: From Contractor.

D. Operation and Maintenance Data: For fuel-fired unit heaters to include in emergency, operation and maintenance manuals.

E. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

B. Source Limitations: Obtain fuel-fired unit heaters through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles and dimensional requirements of fuel-fired unit heaters and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

D. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace heat exchanger of fuel-fired unit heater that fails in materials or workmanship within specified warranty period.

B. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the manufacturers specified.

2.2 GAS-FIRED UNIT HEATERS

A. Available Manufacturers:

1. Hartzell Fan, Inc.
2. Lennox Industries, Inc.
3. Modine Mfg. Co.
4. Reznor/Thomas & Betts.
5. Sterling Gas-Fired Heating Equipment Div.
6. Trane Company (The).

B. Description: Factory assembled, piped and wired and complying with AGA Z83.8, "Gas Unit Heaters."

1. AGA Approval: Designed and certified by and bearing label of American Gas Association.
2. Type of Gas: Designed and built to burn natural gas with characteristics same as those of gas available at project site.

C. Venting: Separated.

D. Housing: Steel with integral draft hood and inserts for suspension mounting rods.

1. External Casings and Cabinets: Baked enamel over corrosion-resistant-treated surface.

E. Heat Exchanger: Aluminized steel.

F. Burners: Aluminized steel with stainless steel inserts.

1. High-Altitude Model: For project elevation above sea level.

G. Unit Fan: Propeller fan with aluminum blades dynamically balanced and resiliently mounted.

1. Steel fan-blade guard.
2. Motors: Totally enclosed with internal thermal-overload protection.

H. Controls: Regulated redundant 24-V AC gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff and manual shutoff all in one body.

1. Gas Control Valve: Single stage.
2. Ignition: Electronically-controlled electric spark with flame sensor.
3. Fan Thermal Switch: Operates fan on heat-exchanger temperature.
4. Vent Flow Verification: Differential pressure switch to verify open vent.

5. Control Transformer: 24 V AC.
6. High Limit: Thermal switch or fuse to stop burner.
7. Thermostat: Single-stage, 24-V AC, wall-mounting type with 50° to 90° F operating range and fan on switch.

I. Discharge Louvers: Independently-adjustable horizontal blades.

J. Accessories:

1. Vertical discharge louvers.
2. Four-point suspension kit.
3. Power Venter: Centrifugal aluminized-steel fan, with stainless steel shaft; 120-V AC motor.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for unit heater piping systems to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install unit heaters level and plumb.

B. Install and connect gas-fired unit heaters and associated fuel and vent features and systems according to NFPA 54, applicable local codes and regulations and manufacturer's written installation instructions.

C. Suspended Units: Suspend from substrate using threaded rods, spring hangers and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.

1. Restrain the unit to resist code-required horizontal acceleration.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Gas Piping: Comply with applicable requirements in Division 15 Section "Fuel Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service. Provide AGA-approved flexible units.

D. Connect vents according to manufacturer’s requirements.

E. Electrical: Comply with applicable requirements in Division 16 Sections.

1. Install electrical devices furnished with heaters but not specified to be factory mounted.

F. Ground equipment according to Division 16.

G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation including piping and electrical connections.

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Verify bearing lubrication.
3. Verify proper motor rotation.
4. Test Reports: Prepare a written report to record the following:
    a. Test procedures used.
    b. Test results that comply with requirements.
    c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

3.5 ADJUSTING

A. Adjust initial temperature and humidity setpoints.

B. Adjust burner and other unit components for optimum heating performance and efficiency.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain fuel-fired unit heaters. Refer to Division 1.

END OF SECTION 15543

SECTION 15550 - BREECHINGS, CHIMNEYS AND STACKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Type B gas vents.
2. Steel, positive-pressure, double-wall vents.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, shipping, installed and operating weights, furnished specialties and accessories.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing refractory-lined stacks similar to those indicated for this project and with a record of successful in-service performance.

B. Source Limitations: Obtain Type B and PS vent system components through one source from a single manufacturer.

C. Comply with SMACNA's "Guide for Steel Stack Design and Construction."

D. Comply with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" for fabricated breechings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Type B Gas Vents:
   a. American Metal Products; a Masco Company.
   b. General Products Co.; Air-Jet Div.
   c. Hart & Cooley, Inc.
   d. Selkirk Metalbestos.
   e. Simpson Dura-Vent Co., Inc.
   f. United McGill Corp.; Airflow Group.
   g. Van-Packer Co.

2. Steel, Positive-Pressure, Double-Wall Vents:
   a. American Metal Products; a Masco Company.

b. General Products Co.; Air-Jet Div.
c. Hart & Cooley, Inc.
d. Selkirk Metalbestos.
e. Simpson Dura-Vent Co., Inc.
f. Van-Packer Co.

2.2 TYPE B GAS VENTS

A. Description: Double-wall gas vents complying with NFPA 211, Type B. Inner pipe of sheet aluminum, outer pipe of galvanized-steel sheet, each with the following minimum thicknesses:

1. Round, 6" and Smaller ID: 0.012" inner pipe, 0.0187" outer pipe.
2. Round, 7" to 18" ID: 0.014" inner pipe, 0.0187" outer pipe.
3. Round, 20" to 24" ID: 0.018" inner pipe, 0.0217" outer pipe.
4. Oval, 4" and Smaller Size: 0.012" inner pipe, 0.0187" outer pipe.
5. Oval, 5" to 6" Size: 0.014" inner pipe, 0.0187" outer pipe.

B. Accessories: Tees, elbows, increasers, draft hood connectors, metal cap with bird barrier, adjustable roof flashing, storm collar, support assembly, thimbles, firestop spacers and fasteners fabricated of similar materials and designs as vent-pipe straight sections.

2.3 STEEL, POSITIVE-PRESSURE, DOUBLE-WALL VENTS

A. Description: Double-wall metal stacks complying with NFPA 211, suitable for use with building heating equipment burning gas, solid or liquid fuels.

B. Construction: Inner and outer metal shells separated by at least 1" airspace, with positive sealing joints.

C. Inner Shell: ASTM A 666, Type 304 stainless steel of the following thicknesses:

1. 6" to 36" Size: 0.035 thick.

D. Outer Jacket: Aluminum-coated steel of the following thicknesses:

1. 6" to 24" Size: 0.025" thick.

E. Accessories: Tees, elbows, increasers, draft hood connectors, termination, adjustable roof flashing, storm collar, support assembly, thimbles, firestop spacers and fasteners fabricated of similar materials and designs as vent-pipe straight sections.

1. Termination: Round chimney top designed to exclude 98 percent of rainfall.

PART 3 - EXECUTION

3.1 INSTALLATION OF MANUFACTURED BREECHINGS, CHIMNEYS AND STACKS

A. Install according to manufacturer's written instructions. Locate to comply with minimum clearances from combustibles.

B. Install, support and restrain according to requirements of seismic zone.
C. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions using sealants recommended by manufacturer.

D. Support vents at intervals recommended by the manufacturer to support weight of vent and all accessories without exceeding loading of appliances.

1. Where maximum unsupported lengths of stack are exceeded, support chimneys as follows:
   a. Guy wires.

3.2 CLEANING

A. After completing system installation, including terminals, inspect exposed finishes. Remove paint splatters and other spots, dirt and debris. Repair damaged finish to match original finish.

B. Clean breechings internally, during and on completion of installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth.

C. Provide temporary closures at ends of breechings and chimneys that are not completed or connected to equipment.

END OF SECTION 15550

SECTION 15731 - PACKAGED TERMINAL AIR CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes packaged terminal air conditioners and their accessories and controls in the following configurations:

1. Through the wall.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties and accessories.

B. Shop Drawings: Show installation details, including seismic bracing, for wall penetrations.

1. Wiring Diagrams: Power, signal and control wiring.

C. Field quality-control test reports.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency for packaged terminal air conditioners.

E. Operation and Maintenance Data: For packaged terminal air conditioners to include in emergency, operation and maintenance manuals.

F. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Product Options: Information on drawings and in specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment and profiles of components and assemblies as they relate to sightlines, to one another and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing and in-service performance.

B. Product Options: Drawings indicate size, profiles and dimensional requirements of packaged terminal air conditioners and are based on the specific system indicated.

C. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

D. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE/IESNA 90.1,

"Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

E. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

1.5 COORDINATION

A. Coordinate layout and installation of packaged terminal air conditioners and wall construction with other construction that penetrates walls or is supported by them.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged terminal air conditioners that fail in materials or workmanship within specified warranty period.

B. Warranty Period for Sealed Refrigeration System: Manufacturer's standard, but not less than five]years from date of Substantial Completion, including components and labor.

C. Warranty Period for Nonsealed System Parts: Manufacturer's standard, but not less than two years from date of Substantial Completion, including only components and excluding labor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Carrier Corp.
2. Climate Master, Inc.
3. GE Co.; GE Appliances.
4. McQuay International.
5. Suburban Mfg. Co.
6. Trane Company (The); North American Commercial Group.

2.2 MANUFACTURED UNITS

A. Description: Factory-assembled and tested, self-contained packaged terminal air conditioner with room cabinet, electric refrigeration system, heating and temperature controls; fully charged with refrigerant and filled with oil.

1. Power Supply: Cord-connected chassis for 230/208-V units. NEMA 6-20P plug.

B. Cabinet: 0.052" thick galvanized steel with removable front panel with concealed latches.

1. Mounting: Wall with wall sleeve.
2. Finish: Baked enamel.
3. Discharge Grille and Access Door: Extruded-aluminum discharge grille with hinged door in top of cabinet for access to controls.
4. Wall Sleeves: Galvanized steel with polyester finish.
5. Louvers: Stamped aluminum with clear-anodized finish.

C. Refrigeration System: Direct-expansion indoor coil with capillary restrictor, hermetically-sealed scroll compressor with internal spring isolation, external isolation, permanent-split-capacitor motor and overload protection. Include the following:

1. Outdoor coil and fan.

D. Indoor Fan: Forward-curved, centrifugal, with permanent-split-capacitor motor and positive-pressure ventilation damper with concealed manual operator.

1. Motor:
   a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
   b. Noise Rating: Quiet.
   c. Electrical devices and connections are specified in Division 16 Sections.

E. Filters: Washable polyurethane in molded plastic frame.

F. Electric-Resistance Heating Coil: Nickel-chromium wire, electric-resistance heating elements with contactor and high-temperature limit switch.

G. Condensate Drain: Drain pan to direct condensate to outdoor coil for re-evaporation] [with slinger ring around outside of outdoor fan.

H. Outdoor Fan: Forward-curved, centrifugal type with separate permanent-split-capacitor motor or driven by indoor fan motor.

1. Motor:
   a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
   b. Noise Rating: Quiet.
   c. Electrical devices and connections are specified in Division 16 Sections.

2.3 CONTROLS

A. Control Module: Unit-mounted off-heat-auto-cool switch and high-low fan switch. Remote-mounted room temperature sensor wired by Division 16.

1. Control Panel Door: Lockable with key.

B. Low-Ambient Lockout Control: Prevents cooling-cycle operation below 40° F outdoor-air temperature.

2.4 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Factory test to comply with ARI 270, "Sound Rating of Outdoor Unitary Equipment."

B. Unit Performance Ratings: Factory test to comply with ARI 310/380, "Packaged Terminal Air-Conditioners and Heat Pumps."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb, maintaining manufacturer's recommended clearances and tolerances.

B. Install wall sleeves in finished wall assembly, seal and weatherproof.

C. Install wall sleeves to withstand, without damage to equipment and structure, seismic forces required by building code.

3.2 CONNECTIONS

A. Electrical System Connections: Comply with applicable requirements in Division 16 Sections for power wiring, switches and motor controls.

B. Ground equipment according to Division 16 Section "Grounding and Bonding."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Inspect for and remove shipping bolts, blocks and tie-down straps.
2. After installing packaged terminal air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Remove malfunctioning units, replace with new units and retest as specified above.

3.4 STARTUP SERVICE

A. After installation, verify the following:

1. Unit is level on base and is flashed in exterior wall.
2. Unit casing has no visible damage.
3. Compressor, air-cooled condenser coil and fans have no visible damage.
4. Labels are clearly visible.
5. Controls are connected and operable.
6. Shipping bolts, blocks and tie-down straps are removed.
7. Filters are installed and clean.
8. Drain pan and drain line are installed correctly.

B. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 16 Sections.

C. Complete installation and startup checks according to manufacturer's written instructions including the following:

1. Lubricate bearings on fan.
2. Check fan-wheel rotation for correct direction without vibration and binding.

D. After startup service and performance test, change filters.

3.5 ADJUSTING

A. Adjust initial temperature and humidity setpoints.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain packaged terminal air conditioners.

END OF SECTION 15731

SECTION 15766 - UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes unit heaters.

1.3 SUBMITTALS

A. Product Data: Include specialties and accessories for each unit type and configuration.

B. Shop Drawings: Submit the following for each unit type and configuration:

1. Plans, elevations, sections and details.
2. Details of anchorages and attachments to structure and to supported equipment.
3. Power, signal and control wiring diagrams. Differentiate between manufacturer-installed and field-installed wiring.
4. Equipment schedules to include rated capacities, shipping, installed and operating weights, furnished specialties and accessories.

C. Field Test Reports: Written reports of tests specified in Part 3 of this Section.

D. Maintenance Data: For unit heaters to include in maintenance manuals specified in Division 1. Include the following:

1. Maintenance schedules and repair parts lists for motors, coils, integral controls and filters.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

1.5 COORDINATION

A. Coordinate layout and installation of unit heaters and building system components with other construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Emerson.
2. Markel.
3. QMark.

2.2 UNIT HEATERS

A. Description: An assembly including filter, chassis, coil, fan and motor in blow-through configuration with heating coil.

1. Cabinet: Recessed, wall mounted.
2. Air Inlet: Front grille.
3. Air Outlet: Front grille.
4. Airflow: Horizontal.

B. Cabinet: For one or more of the following configurations:

1. Recessed, wall-mounting front grilles for air inlet and outlet.

2.3 MATERIALS

A. Chassis: Galvanized steel with flanged edges and unit-leveling bolts.

B. Coil Section Insulation: 1" duct liner complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.

1. Fire-Hazard Classification: Duct liner and adhesive shall have a maximum flame-spread rating of 25 and smoke-developed rating of 50 when tested according to ASTM E 84.

C. Cabinet: Galvanized steel with removable panels fastened with tamperproof fasteners and key-operated access door.

D. Cabinet Finish: Bonderize, phosphatize and flow-coat with baked-on primer ready for field painting.

2.4 ELECTRIC-RESISTANCE HEATING ELEMENTS

A. Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium-oxide insulating refractory and sealed in high-mass steel or corrosion-resistant metallic sheath with fins no closer than 0.16". Element ends shall be enclosed in terminal box. Fin surface temperature shall not exceed 550° F at any point during normal operation.

1. Circuit Protection: One-time fuses in terminal box for over-current protection and limit controls for over-temperature protection of heaters.
2. Wiring Terminations: Match conductor materials and sizes indicated.

2.5 FAN

A. Centrifugal with forward-curved double-width wheels and fan scrolls or propeller made of galvanized steel, aluminum or thermoplastic material; directly connected to motor.

2.6 FAN MOTORS

A. Shaded-pole or permanent-split capacitor multispeed motor with integral thermal-overload protection and resilient mounts. Connect motor to chassis wiring with plug connection.

2.7 ACCESSORIES

A. Filters: 1" thick glass-fiber media in fiberboard frame.

2.8 CONTROL SYSTEMS

A. Control Devices: Unit-mounted fan-speed switch and internal T-stat and disconnect switch.

2.9 SOURCE QUALITY CONTROL

A. Test unit heater coils according to ASHRAE 33.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for electrical connections to verify actual locations before cabinet unit heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install unit heaters level and plumb.

B. Install unit heaters to comply with NFPA 90A.

C. Install wall-mounting units in electrical boxes.

3.3 CONNECTIONS

A. Ground equipment.

B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing and report results in writing:

1. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safeties.

B. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.5 CLEANING

A. After installing units, inspect unit cabinet for damage to finish. Remove paint splatters and other spots, dirt and debris. Repair damaged finish to match original finish.

B. After installing units, clean cabinet unit heaters internally according to manufacturer's written instructions.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain cabinet unit heaters.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing and maintaining equipment.
2. Review data in maintenance manuals.
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.
4. Provide video tape of Owner’s training to Owner.

END OF SECTION 15766

SECTION 15838 - POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Ceiling-mounting ventilators.
2. Propeller fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base air ratings on actual site elevations.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material gauges and finishes including color charts.
5. Dampers including housings, linkages and operators.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components and location and size of each field connection.

1. Wiring Diagrams: Power, signal and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

C. Maintenance Data: For power ventilators to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Ceiling-Mounting Ventilators:
   a. Carnes Company HVAC.
   b. Cook, Loren Company.
   c. Greenheck Fan Corp.
   d. Penn Ventilation Companies, Inc.

2. Propeller Fans:
   a. Acme Engineering & Mfg. Corp.
   b. Carnes Company HVAC.
   c. Chicago Blower Corp.
   d. Cook, Loren Company.
   e. New York Blower Company (The).
   f. Penn Ventilation Companies, Inc.

2.2 CEILING-MOUNTING VENTILATORS

A. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor and fan wheel shall be removable for service.

D. Grille: Plastic louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:

1. Isolation: Rubber-in-shear vibration isolators.
2. Manufacturer's standard roof jack or wall cap and transition fittings.

2.3 PROPELLER FANS

A. Description: Belt-driven or direct-driven propeller fans consisting of fan blades, hub, housing, orifice ring, motor, drive assembly and accessories.

B. Housing: Galvanized steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.

C. Steel Fan Wheels: Formed-steel blades riveted to heavy-gauge steel spider bolted to cast-iron hub.

D. Fan Wheel: Replaceable extruded-aluminum airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.

E. Belt-Driven Drive Assembly: Resiliently mounted to housing, statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.

1. Service Factor Based on Fan Motor: 1.4.
2. Fan Shaft: Turned, ground and polished steel; keyed to wheel hub.
3. Shaft Bearings: Permanently-lubricated, permanently-sealed, self-aligning ball bearings.
   a. Ball-Bearing Rating Life: ABMA 9, L_{10} of 100,000 hours.
4. Pulleys: Cast-iron with split tapered bushing; dynamically balanced at factory.
5. Motor Pulleys: Adjustable pitch for use with motors through 5 HP; fixed pitch for use with motors larger than 5 HP. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
6. Belts: Oil resistant, nonsparking and nonstatic; matched sets for multiple belt drives.
7. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.

F. Accessories:

1. Gravity Shutters: Aluminum blades in aluminum frame; interlocked blades with nylon bearings.
2. Wall Sleeve: Galvanized steel to match fan and accessory size.

2.4 MOTORS

A. Motor Construction: NEMA MG 1, general purpose, continuous duty, Design B.

B. Enclosure Type: Open dripproof.

2.5 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

1. In seismic zones, restrain support units.

C. Install units with clearances for service and maintenance.

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 15 Section "Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Equipment Startup Checks:

1. Verify shipping, blocking and bracing are removed.
2. Verify unit is secure on mountings and supporting devices and connections to ducts and electrical components are complete. Verify proper thermal-overload protection is installed in motors, starters and disconnect switches.
3. Verify cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts and install belt guards.
5. Verify lubrication for bearings and other moving parts.
6. Verify manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
7. Disable automatic temperature-control operators.

B. Starting Procedures:

1. Energize motor and adjust fan to indicated rpm.
2. Measure and record motor voltage and amperage.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and

equipment.

E. Shut unit down and reconnect automatic temperature-control operators.

F. Refer to Division 15 Section "Testing, Adjusting and Balancing" for testing, adjusting and balancing procedures.

G. Replace fan and motor pulleys as required to achieve design airflow.

H. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Lubricate bearings.

3.5 CLEANING

A. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.

B. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt and construction debris and repair damaged finishes.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain power ventilators.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing and maintaining equipment and schedules.
2. Review data in maintenance manuals.
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 15838

SECTION 16000 - TABLE OF CONTENTS

END OF SECTION 16000

SECTION 16001 - ELECTRICAL GENERAL WORK

PART 1 GENERAL:

1.1 Codes, Inspections and Permits: Work to be executed and inspected in accordance with the National Electrical Code and local codes and ordinances. Permits, fees or other charges for inspection or other services shall be paid for by this contractor. Local codes and ordinances are to be considered as minimum requirements and must be properly executed without expense to the Owner, but do not relieve the Contractor from work shown or specified that exceeds the N. E. C. or local codes and ordinances.

1.2 Temporary Electrical Services: Temporary wiring for construction light and power for the General Contractor or other subcontractors shall not be included as a part of this section of the work. Refer to the General Requirements regarding payment for the electrical energy used for construction light and power and for testing of the new installation.

1.3 Work Included: The work shall include all plant, labor, equipment, appliances, materials, transportation, facilities and services necessary for and/or reasonably incidental to the completion of all electrical work, in conformity with the drawings, the specifications and other contract documents, including but not necessarily limited to the work specified herein and indicated on the drawings.

1.4 Work Specified in Other Divisions and Sections:

A. General Work: For concrete, structural steel, and all framed openings performed under this section refer to CONCRETE, STRUCTURAL STEEL and FINISH CARPENTRY AND MILL WORK for standards and materials to be used.

B. Painting: Exposed raceways and electrical apparatus shall be included in the PAINTING SECTION.

C. Mechanical: Refer to Section 16175.

1.5 The Contractor shall carefully inspect the site prior to submitting his bid. No additional charges will be allowed due to the lack of such inspection.

PART 2 MATERIALS:

2.1 General: All materials installed shall be new, of the best quality, with the same brand of manufacturer used for each class of material or apparatus.

2.2 Materials and Responsibility: All materials and apparatus shall be installed in a neat and workmanlike manner by competent specialists for each trade or subtrade. The installation of any materials and apparatus not meeting these standards may be condemned by the Engineer and shall be removed and a replacement installation made at no additional cost to the Owner.

2.3 Substitutions: By specific designation and description, standards are established for materials and apparatus. Other makes, catalog numbers, etc. will be considered, provided such are submitted to the Architect at least seven working days prior to the bid opening. Complete data, performance, dimensions, capacities, specifications, drawings, catalog sheets, etc. shall be submitted for each item in sufficient detail for the Architect or Engineer to determine if each item is acceptable for use on this project. Approved substitutions will be published in an addendum prior to the bid date.

2.4 Project Design: is based on the material and apparatus indicated on the drawings and/or

specified herein. Any changes required to suit the approved substitute materials and apparatus shall be made by the Contractor at no additional costs to the Owner.

2.5 Submittals:

A. Within thirty days after award of the contract the contractor shall submit, for approval, complete data for all materials and apparatus specified or indicated on the drawings. Included shall be performance, capacities, ratings, materials, dimensions, catalog numbers, catalog or data sheets, etc. Shop drawings shall be provided for apparatus factory assembled for this project. Provide sufficient copies of each item for retention of one copy by the Architect and three copies by the Engineer. The Architect is to be the sole judge as to the acceptibility of the items submitted.

B. Submittal items shall be grouped and identified by specification sections with a suffix indicating the serial (sequence) number of the submittal for each section. For example the first submittal for Section 16470 shall be "16470-S1" and "16470-S2" for a resubmittal, etc.

C. Do not group all sections in a single binder - sections shall be submitted separately.

D. Prior to submittal of shop drawings, catalog sheets, data sheets, etc., the contractor shall review these items and mark corrections in red. Each section of submittals shall be dated and signed by both the electrical and general contractors' representatives to certify that they have been reviewed and corrected.

PART 3 EXECUTION:

3.1 All contract drawings are a part of the electrical work insofar as they apply, as if referred to in full. The drawings of floor and ceiling installations are made at small scale and outlets are indicated only in their approximate locations, unless dimensionned. Locate outlets and apparatus symmetrically on floors, walls and ceilings, where not dimensionned, and coordinate such locations with work of other trades to prevent interferences. Verify all dimensions on the job. Do not "scale" the electrical drawings. Refer to architectural and mechanical plans, details and dimensions.

3.2 Provide storage space for materials and apparatus supplied under this section and assume complete responsibility for losses due to any cause whatsoever. The storage shall not interfere with traffic conditions in any public thoroughfare. Weather and dust protection shall be provided to insure that the materials and apparatus are in "factory new" condition when installed. Protect installed materials and apparatus to prevent damage or soiling due to weather, water, chemicals or accident.

3.3 Perform all cutting, drilling, patching and refinishing of the building structure required during rough construction as a part of this section. Where finished construction is cut or drilled, patching and refinishing of such items shall be performed by the trades so affected, at the expense of the electrical subcontractor.

3.4 Cooperate with other crafts and trades in coordination of rough and finished work. Promptly respond when notified the construction is ready for installation of work under this section. The electrical contractor shall be held responsible for any delays which might be caused by his negligence or failure to cooperate with the general contractor or any other subcontractor.

3.5 Electrical Systems Identification:

A. Conduit Markers: Provide standard industry color coded (ANSI A13.1) banding for exposed raceways; with printed identification of service. Locate markers at ends of

lines, near major branches, apparatus locations, near penetrations where lines become concealed, and at 50'-0" maximum intervals of exposure. Small size (1" and less) raceways need not be marked, if less than 40'-0" in length.

B. Underground Raceways: Bury a minimum 6" wide, orange, vinyl tape over underground raceways where outside of building lines. The tape shall be imprinted to indicate "ELECTRICAL". Locate the tape 12" nominally below finished grade.

C. Conductors: Provide factory imprinted labels on specialty conductors such as high voltage, communication, alarm, etc. Locate labels at junction boxes, outlets, splices, etc.

D. Feeder conductors: label with plastic tags or double turns of colored vinyl tape at each end and in junction or pull boxes.

E. Equipment and Apparatus: Bolt laminated plastic (black with white core) labels on the interior trim of branch panels and on the exterior of mechanical equipment control switches, motor starters, disconnect switches, terminal cabinets, major pull boxes, etc. Labels shall have 1/4" high engraved letters indicating function, size, etc. of the respective item.

F. Circuit Directories: Refer to Section 16470 for panel circuit directories and emergency circuit identification.

G. On Panel PA provide an engraved label indicating:

D. BROWN, ARCHITECT
O'ROUARK ENGINEERING, INC.
(Contractor's Name)
(Month and Year of Installation)

3.6 The entire electrical installation shall be complete in every detail as specified and/or indicated on the drawings, tested at full lighting and power load in the presence of the Architect or Engineer, ready for use and clear of all grounds and shorts.

3.7 All of the following items must be completed prior to final inspection. No final payment will be made until all are completed. If substantial deficiences or incompletions are found at the final inspection requiring a reinspection by the Architect or Engineer, the costs of such reinspection will be at the expense of the Contractor.

A. Cleaning of Apparatus and Premises: Thoroughly clean all parts of the apparatus, lighting fixtures, etc. Exposed parts that are to be painted shall be cleansed of all concrete, plaster or other construction materials and oil and grease removed. Interiors of apparatus, outlet boxes, pull boxes, etc. shall be cleaned and wiped. Interior and exterior rust shall be removed and the surface refinished to match the factory original.

B. Operation and Maintenance Manuals: the electrical contractor shall include in his bid proposal an allowance of $200.00 for preparation of these manuals by the Electrical Engineer. The latter will retain copies of submittals for use in the manuals.

C. As Constructed Drawings: Two sets of blue line electrical drawings will be provided for the the Contractor to use on a daily basis to indicate the work as actually installed. The Contractor shall neatly mark with red pencil, at the end of each working day, the changes made. These shall be kept in the project job site office and shall not be used outside of the office and shall be available for viewing by the Architect

or Engineer during site visits. At the conclusion of the project, the drawings shall be signed by the Contractor, dated and transmitted to the Architect. The final inspection will not be made until they are accepted by the Architect.

3.8 Guarantee:

A. All work under this section shall be guaranteed, in writing, to be free of defective workmanship, installation, materials or apparatus for a period of one year from date of "Substantial Completion".

B. Excepted: Fluorescent and incandescent lamps which shall be guaranteed for 30 days from that date. HID lamps shall be guaranteed for one year from the date of substantial completion. Electronic fluorescent ballasts shall be guaranteed for four years, RE: 16510.

C. Repairs, replacements of any such defects, failures or inoperativeness shall be corrected and performed under this division at no cost to the Owner.

D. Under this division, submit two, signed copies of a letter incorporating this guarantee, with entries indicating the dates of project acceptance and expiration of the guarantee. These shall be submitted on or before the date of final inspection and will be inserted in the Operation and Maintenance Manuals.

3.9 Instructions of the Owners Personnel: Prior to the final inspection the contractor shall conduct an on-site instructional tour of the entire project with personnel designated by the Owner. It shall include directions for operation of all systems supplied and/or installed under this division, including elementary trouble shooting procedures, preventative maintenance, use of the Operation and Maintenance Manuals, cleaning and relamping of lighting fixtures, etc. Provide a letter, signed by the Owner, indicating that the Owner has received the specified instructions.

3.10 Receipts for Delivered Materials and Supplies: Submit on or before the day of final inspection, receipts signed by the Owner or his representative, for these items as noted in other sections of this division. These will be inserted in the Operations and Maintenance Manuals.

PART 4 PROJECT CLOSEOUT:

The form following this page shall be completed and the actions noted thereon taken prior to the *Substantial Completion* inspection. Upon completion copies of the list will be inserted into the Operation and Maintenance Manuals.

END OF SECTION 16001

ELECTRICAL PROJECT COMPLETION CHECK LIST

PROJECT: ITD ORCHARD MAINTENANCE BUILDING

AS REQUIRED IN THE PROJECT SPECIFICATIONS, THE FOLLOWING ITEMS SHALL BE COMPLETED BY THE ELECTRICAL CONTRACTOR AND COMPLETED COPIES OF THIS FORM TRANSMITTED TO THE ARCHITECT AND O'ROUARK ENGINEERING, INC. PRIOR TO THE DATE OF THE FINAL INSPECTION (the respective Specification sections are noted for each item):

A. PROJECT DOCUMENTS (16001):

1. Prepare two sets of electrical "as-constructed" marked prints (16001). Forward one set to the Architect and one set to O'Rouark Engineering (16001)

   _____

2. Deliver two copies of the Guarantee for Division 16 to O'Rouark Engineering, Inc. for inclusion into the Operation and Maintenance Manuals (16001):

   _____

3. Deliver two copies of the spare fuse inventory O'Rouark Engineering, Inc. for inclusion into the Operation and Maintenance Manuals (16475):

   _____

4. Deliver two copies of the spare lamp inventory O'Rouark Engineering, Inc. for inclusion into the Operation and Maintenance Manuals (16510):

   _____

5. Deliver two copies of the electronic fluorescent ballast warranty to O'Rouark Engineering, Inc. for inclusion into the Operation and Maintenance Manuals (16001 and 16510):

   _____

B. THE MATERIALS IN THE FOLLOWING ITEMS SHALL BE DELIVERED TO THE OWNER, WITH EACH ITEM RECEIPTED FOR BY THE OWNER'S REPRESENTATIVE DATING AND SIGNING THE RESPECTIVE BLANK LINE:

1. Spare fuses and inventory list (16001):

   By:_____ Date:_____

   Printed Name: _____

2. Spare lamps and inventory list (16001):

   By:_____ Date:_____

   Printed Name: _____

C. INSTRUCTION SESSIONS FOR THE FOLLOWING SYSTEMS, ACKNOWLEDGED BY THE OWNER'S REPERESENTATIVE DATING AND SIGNING THE RESPECTIVE BLANK LINE:

1. Electrical distribution, lighting, power, etc. (16001):

   By:_____ Date:_____

   Printed Name: _____

SECTION 16002 - ELECTRICAL SERVICE

PART 1 SCOPE:

1.1 Under this division supply, install and connect materials and apparatus to form a complete system including but not limited to the following:

A. Service raceways.
B. Service conductors.
C. Metering facilities.
D. Protective devices.
E. Disconnect(s).

PART 2 SECONDARY SERVICE ENTRANCE:

2.1 Characteristics: 208Y/120 volts, three-phase.

2.2 Type: Underground from the Idaho Power Co. pad mounted transformer.

2.3 Raceways: As specified for feeders.

2.4 Conductors: As specified for feeders.

PART 3 PRIMARY SERVICE:

3.1 The supply and installation of underground primary service and the pad mounted transformer will be by Idaho Power Co. RE: Part 4 for the charges.

PART 4 SERVICE CHARGES:

4.1 The Electrical Contractor shall include in his bid proposal an allowance of $12,000 for payment to the serving utility for the cost of service connections to the utility's lines. Included shall be charges for the new construction plus any line or pole relocations caused by this project.

4.2 The allowance shall be based on the invoice amount from the serving utility and shall not include the Contractor's overhead, taxes or profit. The final contract amount will be adjusted to reflect the actual charges from the utility.

PART 5 ELECTRICAL ENTRANCE APPARATUS:

5.1 The service disconnect(s) shall be as indicated on the drawings.

5.2 Metering: Under this division provide metering facilities as directed by the serving utility and as indicated on the drawings.

END OF SECTION 16002

SECTION 16003 - TELEPHONE SERVICE ENTRANCE

PART 1 SCOPE:

1.1 Under this division supply, install and connect materials and apparatus to form a complete system *including but not limited to the following:*

1.2 Service raceways and accessories.

1.3 Terminal board and grounding.

PART 2 SERVICE ENTRANCE:

2.1 Type: Underground.

2.2 Raceways: As specified for feeders.

2.3 Conductors: Supplied and installed by the telephone utility.

2.4 Pull rope: Provide a multi-filament polyethylene pull rope in the raceway.

PART 3 SERVICE CHARGES:

3.1 The Electrical Contractor shall include in his bid proposal an allowance of $2,000.00 for payment to the serving utility for the cost of service connections to the utility's lines. Included shall be charges for the new construction plus any line or pole relocations caused by this project. The allowance shall be based on the invoice amount from the serving utility and shall not include the Contractor's overhead, taxes or profit. The final contract amount will be adjusted to reflect the actual charges from the utility.

PART 4 ENTRANCE APPARATUS:

4.1 Terminal board: Provide a terminal board and electrical outlet as noted on the drawings.

4.2 The service entrance raceway shall from the utility's connection point, as noted on the drawings, and terminate at the telephone terminal board.

4.3 Termination connection equipment will be supplied, installed and connected by the serving utility.

4.4 Grounding: Provide a #2 BC ground conductor in 3/4" PVC from the terminal board to the building electrical ground system. Provide 6'-0" slack conductor at the terminal board for connection by the serving utility.

END OF SECTION 16003

SECTION 16045 - ELECTRICAL RELATED WORK

PART 1 GENERAL

1.1 EXCAVATING AND BACKFILLING FOR ELECTRICAL WORK:

A. General: Except where excavating/backfilling is indicated as work of another division, or electrical work can be performed integrally with other work in the same excavation, excavate and backfill as required for proper performance of electrical work. Coordinate with other work and patch or repair to fully restore landscape work, pavement and other work where disturbed. Provide materials for backfilling as indicated.

B. Subbase Material: Graded gravel, sand or crushed stone. Where finely-graded material is required, provide gradation passing passing 3/8" sieve.

C. Backfill Material: Soil: AASHTO M145, A-1, A-2-4, A-2-5 or A-3.

D. Backfilling: Treat backfill material for proper compaction by drying, moisturizing or thawing. Backfill in 8", or less, compacted layers of the following densities:

E. Nonpaved Areas: 85% for cohesive soil, 90% for noncohesive soil.

F. Paved Areas: 90% for cohesive soil, 89% for noncohesive soil.

2.2 ACCESS TO ELECTRICAL WIRING OR APPARATUS:

A. General: Except where access is indicated as work of another division, provide access to concealed electrical wiring or apparatus, adequate for operation, maintenance and compliance with the N.E.C. Provide access doors of types indicated, except where removable-plate type or other suitable type of unit will provide adequate access.

B. Provide locked units where indicated. Where located in painted surface area, provide units primed for painting, unless another finish is indicated.

C. Door Construction: Welded steel, ground smooth, 16-gage frames and 14-gage panels, 175 degree swing spring hinges, cam locks. Provide 5-pin/disk cylinder locks where indicated.

2.2 UL Compliance: Where UL fire-resistance rating is indicated for penetration by access units, provide UL-Listed and labeled units, except for those units which are smaller the minimum size requiring ratings as recognized by the governing authority.

2.3 CONCRETE FOR ELECTRICAL WORK:

A. General: Comply with the applicable requirements of Division-3 sections regarding reinforcement, mixing, placing and finishing of concrete installed under this division. Provide strength classes, with content limitations indicated, for applications as follows and for similar applications:

B. Class 4000: 565 lbs. cement/yd, 0.75 water/cement ratio; for vaults and beam-type foundations.

C. Class 3000: 500 lbs. cement/yd, 0.75 water/cement ratio; for plain encasement and fill of steel-framed units.

D. Class 2500: 450 lbs. cement/yd, 0.75 water/cement ratio; for plain encasement and fill of steel-framed units.

E. Rough Grouting Class: 565 lbs. cement/yd, 0.75 water/cement ratio, limited aggregate size; for rough grouting (not for setting apparatus bases).

F. Backfill Class: 375 lbs. cement/yd, 0.87 water/cement ratio; for backfilling excavations below level of support.

PART 3 INSTALLATION:

3.1 Provide excavating and concrete work as indicated and in compliance with recognized standard industry practices.

3.2 Install access units as indicated, in accordance with apparatus manufacturer's written instructions and in compliance with the N.E.C., to ensure that access doors fulfill requirements.

3.3 Coordinate with other work, including substrate construction work, as necessary to interface excavating, backfilling, concrete work, installation of access doors, etc. with other trades and crafts.

END OF SECTION 16045

SECTION 16110 - ELECTRICAL RACEWAYS

PART 1 GENERAL:

1.1 NEMA Compliance: Comply with applicable portions of the the National Electrical Manufacturers standards pertaining to electrical raceways.

1.2 UL Compliance and Labeling: Comply with applicable portions of Underwriters Laboratories safety standards pertaining to electrical raceways. Provide products which have been UL-listed and labeled.

1.3 N.E.C. Compliance: Comply with the National Electrical Code (NFPA No. 70) as applicable to construction and installation of electrical raceways.

1.4 Provide electrical raceways of types, grades, sizes, weights (wall thicknesses), number of channels, etc. for each service indicated. Provide complete assembly of raceways including, but not necessarily limited to, couplings, offsets, elbows, expansion joints, adapters, holddown straps, clamps, end caps and other components and accessories as needed for a complete system.

PART 2 MATERIALS:

2.1 Raceways: Provide Rigid Steel Conduit (RGS), Intermediate Metal Conduit (IMC), Flexible Metallic Tubing (FMT), Rigid Nonmetallic Conduit (RNC) as directed and/or permitted in the "Execution" paragraphs herein.

2.2 Fittings, connectors, etc. shall be compatible with the particular raceway in use at each location. All metallic raceway fittings shall be galvanized steel. Plastic raceways fittings shall be the same material as the raceway.

2.3 EMT fittings, connectors and couplings shall be all steel. Box connectors shall have smooth edged insulated throats and lock nuts for attachment to apparatus or outlet boxes. Couplings and connectors shall use a set screw or compression nut for fastening to the raceway. Indenter fittings are not acceptable. Die cast fittings are not acceptable.

PART 3 EXECUTION:

3.1 Install electrical raceways where indicated, in accordance with manufacturer's written instructions and comply with applicable portions of the N.E.C. and NECA's "Standard of Installation".

3.2 All raceways shall be run concealed in the walls, ceilings, floors or under floors except exposed in the vicinity of surface mounted apparatus and as specifically noted on the drawings. Where run exposed, they shall be run tight to building surfaces and parallel to building lines.

3.3 Complete the installation of electrical raceways before commencing installation of conductors in the raceways.

3.4 Coordinate with other work as necessary to interface installation of the raceways with other work and trades.

3.5 Level and square raceway runs and install at proper heights.

3.6 (Not used)

3.7 Where RGS or IMC raceways are installed in contact with earth or fill, the entire portion of the raceways so installed shall be wrapped with "Scotch" No. 51 vinyl tape, half-lapped.

3.8 RNC Conduit heating for bending shall be only with the use of factory fabricated heat troughs or with wrap-around heat blankets. Raceways found to be heated with torches shall be removed and replaced with those installed as required herein.

3.9 Provide accessible pull or junction boxes to limit each branch circuit to 100 feet of raceway and/or three 90 degree bends. Feeders shall be limited to 150 feet and/or two 90 degree bends.

3.10 Conductor Installation: As indicated on the drawings and not doubled-up in "home runs". Raceways shall be run between outlets, junction boxes, pull boxes, apparatus, panelboards, etc. as indicated on the drawings. Changes in routing shall be made only with the specific approval of the Architect or Engineer and shall be carefully recorded on the As-constructed Drawings.

3.11 Steel Conduit (RGS or IMC): Shall be the basic raceway for all conductors. The Contractor shall have the option of using other specific types within the limitations as noted in the following paragraphs. RGS and IMC shall be the only raceways used in structural concrete.

3.12 Electrical Metallic Tubing (EMT): May be used, at the contractor's option, only in the following locations and conditions:

A. Furred ceilings.
B. In wood frame construction.
C. In interior concrete block, masonry or brick walls (not exterior cavity walls).
D. Exposed within building interiors where not exposed to moisture or physical injury.

3.13 Rigid Nonmetallic Conduit (RNC): May be used, at the contractor's option, only in the following locations and conditions:

A. In the earth under the building and beyond building lines.
B. In concrete floor slabs on grade, not structural slabs.
C. In concrete block, masonry or brick walls.

3.14 Flexible Steel or Aluminum Conduit: Shall be used only for flexible connections at lighting fixtures, motors, at portable equipment or as noted on the drawings. These materials shall not be used elsewhere for feeder or branch circuit wiring.

3.15 Electrical Nonmetallic Tubing (ENT): Is not acceptable on this project.

END OF SECTION 16110

SECTION 16120 - WIRES AND CABLES

PART 1 GENERAL:

1.1 UL Compliance and Labeling: Comply with applicable UL safety standards pertaining to wires, cables and conductors. Provide products which are UL-listed and labeled.

1.2 N.E.C. Compliance: Comply with N.E.C. as applicable to construction and installation of wires, cables and connectors.

1.3 ASTM compliance: Comply with ASTM-B-3 pertaining to conductor materials. Provide copper conductors with conductivity of not less than 98% at 20 deg. C.

PART 2 MATERIALS:

2.1 Provide wires of types, ratings, materials and sizes as indicated for each service. Select from the following those wire construction features required for the project:

2.2 Feeders: Stranded copper, Type THHN (THWN).

2.3 Branch Circuits: Copper, Type THHN (THWN), solid for No. 10 and smaller, stranded for No. 8 and larger.

2.4 Low Voltage Remote Control: Plastic insulated, copper cables, 50 volts minimum insulation rating.

PART 3 EXECUTION:

3.1 Install wires and cables, and wiring connectors as indicated, in accordance with recognized industry installation practices. Comply with applicable portions of N.E.C. and NEMA standards and NECA's "Standard of Installation".

3.2 All feeder and branch circuit conductors shall be color coded with the conductors on each "phase" using the same, distinctive color throughout the system. Color sequencing:
Phase A: black, Phase B: red and Phase C (if used): Blue. RE: 16450 for grounding conductors. Switch legs and 3-way "traveller" conductors shall be separately identified by color. RE: 16001, 3.5, D. for feeders.

3.3 Raceways shall be used for all power, control and communications conductors, unless specifically exempted, as specified under "Electrical Raceways".

3.4 Coordinate with other work, including electrical raceway and apparatus installations, as necessary to interface wire and cable installations with other work,

3.5 Prior to system energization test all conductors for continuity, grounds and short circuits, and correct deficiencies.

3.6 Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with the requirements.

END OF SECTION 16120

SECTION 16140 - ELECTRICAL BOXES AND FITTINGS

PART 1 SCOPE:

1.1 This section applies to all switch, outlet, junction, pull, lighting fixture and similar boxes.

1.2 N.E.C. Compliance: Comply with N.E.C. as applicable to construction and installation of electrical wiring boxes and fittings.

1.3 UL Compliance: Comply with UL Standard Numbers 50, 514 and 886. Provide electrical boxes and fittings which are UL-listed and labeled.

1.4 ANSI/NEMA Standards Compliance: Comply with ANSI C134.1 (NEMA Standards Pub. No. OS-1) as applicable to sheet-steel outlet boxes, device boxes and box supports.

PART 2 MATERIALS:

2.1 Interior Outlet Boxes: Provide galvanized flat rolled sheet steel interior outlet wiring boxes, of types shapes and sizes, including box depths, to suit each respective location and installation; construct with standard knockouts in back and sides, and with threaded screw holes with corrosion-resistant screws for securing box covers and wiring devices.

2.2 Weatherproof Outlet Boxes: Provide corrosion-resistant cast-metal weatherproof outlet wiring boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit ends, cast-metal faceplates, with spring-hinged waterproof caps suitably configured for each application, including face plate gaskets and corrosion-resistant fasteners.

2.3 Junction and Pull Boxes: Provide galvanized code-gage sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suit each respective location and installation, with welded seams and equip with stainless steel nuts, bolts, screws and washers.

2.4 (Not used)

2.5 Conduit Bodies: Provide galvanized cast-metal conduit bodies, of types, shapes and sizes to suit respective locations and installation, construct with threaded conduit entrance-ends, removable covers, cover gaskets and corrosion-resistant screws.

2.6 Bushings, Knockout Closures and Locknuts: Provide malleable iron conduit bushings where conduits enter boxes for No. 6 and smaller conductors. For No. 4 and larger conductors, use bushings having integral phenolic insulating inserts. Provide corrosion-resistant steel knockout closures to cover punched-out holes not to be used for raceways. Provide corrosion-resistant locknuts to secure raceways and fittings at boxes.

PART 3 EXECUTION:

3.1 Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions and with recognized industry practices.

3.2 Coordinate installation of electrical boxes and fittings with wire/cable and raceway installation work.

3.3 Provide weatherproof outlet boxes for exterior locations and for interior locations exposed to moisture.

3.4 Install boxes and conduit bodies in those locations that will assure ready accessibility of electrical wiring.

3.5 Fasten boxes rigidly to substrates of structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.

3.6 Where boxes are installed in wood or steel framed ceilings, each shall be supported on steel bar hangers spanning between joists.

3.7 Where outlet boxes are installed in steel or wood framed walls they shall be mounted on Caddy No. RBS16 box mounting brackets (RBS24 for 24" spaced studs) or equal by Case Electrical Enterprises. Fastening boxes directly to studs or joists with nails, screws or box brackets is not acceptable.

3.8 Provide grounding connections, sufficiently tight to assure permanent and effective grounds, where indicated for installed electrical boxes.

END OF SECTION 16140

SECTION 16142 - ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 GENERAL:

1.1 NFPA Compliance: Comply with N.E.C. (NFPA No. 70).

1.2 UL and NEMA Compliances: Provide products which are UL-listed and labeled, and connections complying with NEMA construction standards.

1.3 IEEE Compliance: Comply with Std. 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings".

1.4 ANSI Compliance: Comply with applicable ANSI standards pertaining to products and installation of electrical connections.

1.5 For each electrical connection indicated, provide complete assembly of materials, including pressure connectors, terminals (lugs), electrical insulating tape, electrical solder, electrical soldering flux, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories as needed to complete splices and terminations of type indicated.

PART 2 MATERIALS:

2.1 Raceways: Provide conduit and tubing complying with Section 16110.

2.2 Wires and Cables: Provide wires and cables complying with Section 16120. Unless otherwise indicated, provide wires, cables and conductors for electrical connections which match wires, cables and conductors of those supplying power to apparatus.

2.3 Electrical Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing and boots, solder for electrical work, cable ties, wire nuts, lugs and clamps as recommended for use by accessories manufacturers for the type of services indicated.

PART 3 EXECUTION:

3.1 Install electrical connections as indicated; in accordance with connector manufacturer's written instructions and complying with N.E.C. and NECA"s "Standards of Installation".

3.2 Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment, where ever possible.

3.3 Cover splices with electrical insulation equivalent to, or of higher rating than, insulation of the conductors being spliced.

3.4 Trim wires and cables to be as short as practicable and arrange routing to facilitate inspection, testing and maintenance.

3.5 Provide flexible conduit for motor connections, and other locations as indicated where subject to movement and vibrations. Maximum length shall be 3'-0".

3.6 Refer to Section 16001 for identification of electrical power supply conductors, terminations, phases, etc. Affix labels at each point of termination, as close as possible to each point of connection.

END OF SECTION 16142

SECTION 16143 - WIRING DEVICES

PART 1 GENERAL:

1.1 UL Compliance and Labeling: Comply with UL 20, 498 and 943 and provide wiring devices which have been UL-listed and labeled.

1.2 N.E.C. Compliance: Comply with N.E.C. as applicable to construction and installation of electrical wiring devices.

1.3 NEMA Compliance: Comply with NEMA standards for general and specific-purpose wiring devices.

1.4 Provide factory-fabricated wiring devices, in types, colors, and electrical ratings for applications indicated and complying with NEMA Stds. Pub. WD-1. Provide ivory color devices except as otherwise selected. Color selection shall be verified, by the Contractor, with the Architect.

PART 2 MATERIALS:

2.1 Duplex Receptacles: 20-amperes, NEMA configuration No. 5-20R, back and side wired, nylon face, one-piece plated steel wrap-around yoke. Federal Specifications W-C-596 (current issue), NEMA Test WD 1-3, mount horizontally.

2.2 Ground Fault Circuit Interrupters (GFCI): Provide general-duty, duplex, ground-fault circuit interrupter receptacles, feed through type, capable of protecting connected downstream receptacles on single circuit, grounding type; UL 943 Class A and 498, Group 1; 20-amperes rating, 125-volts, 60 Hz; with solid state ground-fault sensing and signalling; with 5-milliampere ground-fault trip level; NEMA configuration No. 5-20R; mount horizontally.

2.3 (Not used)

2.4 Wall Switches: 20-amperes, A.C., 277-volts, back and side wired, Federal Specifications W-S-896 (current issue); Type III.

2.5 Provide switch and receptacle plates for wiring devices with ganging and cutouts as indicated, provide with metal screws for securing plates to devices. Screw heads shall be finished to match the plate finish.

2.6 Wall Plates Material and Finish (except as noted herein): 0.035" thick, Type 302 satin finished stainless steel.

2.7 Exterior Devices: Devices mounted on the exterior shall be installed with an outlet enclosure (cover) clearly marked: "Suitable For Wet Locations While In Use". There shall be a gasket between the enclosure and mounting surface, and between the cover and base to assure a proper seal. The enclosure shall use stainless steel mounting hardware, be constructed of impact resistant polycarbonate and UL listed. The enclosure shall be manufactured by Taymac or approved equal.

2.8 Exterior receptacles (GFCI/WP): Recessed weatherproof; Taymac No. 72204 fittings; with GFCI receptacle. These outlets only shall be mounted in the vertical configuration.

2.9 Galvanized steel plates shall be used in unfinished spaces.

2.10 Surface Mounted Devices shall have galvanized steel plates dimensioned to be flush with the edges of the outlet box.

PART 3 EXECUTION:

3.1 Install wiring devices as indicated, in compliance with manufacturer's written instructions, applicable requirements of N.E.C. and NEMA's "Standard of Installation".

3.2 Install wiring devices only in boxes which have been cleaned of building materials and dirt.

3.3 Delay installation of devices until all conductors have been installed in the respective boxes.

3.4 Delay installation of wall plates until the device installations have been approved by the Engineer and painting work has been completed at the respective locations.

3.5 Test wiring devices for compliance with requirements, including polarity, grounding continuity and operation of the GFCI controls.

END OF SECTION 16143

SECTION 16170 - MOTOR AND CIRCUIT DISCONNECTS

PART 1 GENERAL:

1.1 N.E.C. Compliance and Labeling: Comply with UL File E2875, UL 98 and each shall be UL-listed and labeled.

1.2 NEMA Compliance: Comply with NEMA KS1-1975 for Type HD switches.

1.3 Federal Specifications: Comply with W-S-865 (current issue) for the respective types of switches specified.

PART 2 MATERIALS:

2.1 Provide switches as indicated on the drawings and as specified herein for motor or appliance disconnects, for branch circuit or feeder protection and for service disconnects.

2.2 Enclosures shall be NEMA Type 1 unless indicated otherwise on the drawings or specified herein.

2.3 Mechanisms shall have quick-make, quick-break contacts with the blades visible in the "OFF" position with the door open. The operating handle shall have facilities for padlocking in the "OFF" position and for padlocking the door in the closed position. The position of the handle shall clearly indicate the "OFF" and "ON" positions.

2.4 Door interlocks shall prevent opening of the door when the switch is in the "ON" position. Provide a by-pass operated by inserting a screwdriver in an unlabeled slot to allow opening of the door in the "ON" position. Interlocks consisting of a cover or body mounted bolt that is removed for by-passing are not acceptable. The door and the interlock shall be secure to *the extent that it can't be manually forced by bending or prying of the handle or door.*

2.5 Fuse clips, where indicated, shall be the reinforced, positive pressure type.

PART 3 EXECUTION:

3.1 Install switches, as indicated on the drawings, with the operating handle at 5'-0" above adjacent floor level, unless noted otherwise. Comply with the manufacturer's written instructions for installation, applicable requirements of N.E.C., NEMA and NECA "Standards of Installation". Conductors shall enter the enclosures at the top of the enclosure and exit at the bottom of the enclosure.

3.2 Supply and install fuses, where indicated or as specified herein. Fuse types and ratings shall be as indicated on the drawings and as specified in Section 16475.

3.3 Grounding: Provide electrically continuous, tight grounding devices and conductors to insure safety to personnel and provide low impedance ground fault return paths.

END OF SECTION 16170

SECTION 16175 - MOTOR AND TEMPERATURE CONTROL WIRING

PART 1 GENERAL:

1.1 Under Division 16 provide complete raceway systems for motor and temperature controls.

1.2 Under Division 16 supply install and connect temperature control conductors.

1.3 Under Division 16 supply, install and connect motor control conductors.

1.4 Under Division 16 supply, install and connect motor disconnects, manual motor starters, relays, push buttons, control stations, pilot lights, power supply and control raceways and conductors, etc. to form a complete electrical system to supply power to and control all electrically operated and/or controlled equipment supplied by the Owner or other divisions of these Specifications.

1.5 Disconnects, Motor Starters, Relays and Control Devices: Factory assembled into packaged units, will be furnished and installed under Division 15 and/or other divisions of these Specifications.

1.6 Pressure Switches, Valves, Damper Motors, Float Switches, etc., will be supplied and installed under Division 15. Electrical connections to these devices shall be made under Division 16.

PART 2 MATERIALS:

2.1 Raceways, outlets, fittings, etc. shall be supplied for the various building constructions as noted for branch circuits in Section 16110.

2.2 Motor control conductors shall be color coded and labeled at each end to indicate their function.

2.3 All conductors supplied under this section shall be rated at line voltage and conform to the requirements for branch circuits as noted in Section 16120.

2.4 Refer to Section 16170 for disconnects.

2.5 Refer to Section 16480 for motor starters, controls, etc.

PART 3 EXECUTION:

3.1 Raceways shall be used for all temperature and motor control conductors, for all voltages.

3.2 The raceway system noted on the drawings indicate the general scope, routing and sizes of raceways. The electrical contractor shall verify these items with the mechanical installer(s) prior to commencing the "rough-in". If instructions are received for changes in the routing, etc. such changes shall be carefully indicated on the as-constructed marked prints.

3.3 Temperature control raceways shall be terminated in or adjacent to the control apparatus as directed by the mechanical installer. Where terminated adjacent to the apparatus, a capped outlet box shall be provided under this section, with raceway extension(s) to the mechanical apparatus, from the box, by the mechanical installer.

3.4 Under Division 16 motor control raceways and conductors shall be connected to the respective motor controllers and to the mechanical control cabinet(s) or devices. The mechanical installer will provide diagrams for connecting the motor control conductors at the

latter cabinets.

3.5 Interface of the motor controls with the mechanical system shall be with "dry contacts" in the mechanical control panel(s) or devices, rated at line voltage and of adequate rating for the amperage of the motor starter coils. The control voltage for motor starters, etc. provided by Division 16.

3.6 All motor starters shall have "HAND-OFF-AUTO" switches to control the respective motors. Where there are interfaces with the mechanical control system(s), the "AUTO" position shall be for connection to the mechanical control panel(s) or devices

3.7 When the mechanical and electrical systems are complete the electrical and mechanical contractors shall demonstrate the specified motor control functions and sequences in the presence of the Mechanical and Electrical Engineers.

END OF SECTION 16175

SECTION 16450 - ELECTRICAL GROUNDING

PART 1 GENERAL:

1.1 Scope: The extent of electrical grounding work is indicated on the drawings and schedules and by requirements of this section. Grounding of electrical installations comprises both system and equipment grounding and includes, but is not necessarily limited to, metal raceways, transformer frames, switchgear enclosures, metal enclosures of electrical devices and circuit conductors.

1.2 Electrical wire, cable connectors clamps and raceway work are specified in applicable Division 16 basic wiring materials sections.

1.3 NFPA Compliance: Comply with Article 250 of NFPA No. 70 (NEC), as applicable to materials and installation of electrical grounding systems and associated equipment and wiring.

1.4 UL Compliance: Comply with UL standards pertaining to electrical grounding and bonding.

1.5 IEEE Compliance: Comply with applicable IEEE standards pertaining to electrical grounding.

PART 2 MATERIALS:

2.1 Unless otherwise indicated, provide electrical grounding conductors for grounding connections as follows:

2.2 Feeders: Ground conductors shall be bare copper. Insulated conductors may be used provided that all visible portions of the insulation are wrapped with green vinyl tape, half-lapped.

2.3 Branch Circuits: Conductors shall be green insulated.

2.4 Grounding conductors shall be copper. No. 8 and smaller shall be solid or stranded. No. 6 and larger shall be stranded.

PART 3 EXECUTION:

3.1 Connections: All ground conductor connections shall be made with factory or field installed lugs. Outlet boxes may be connected to ground conductors using factory installed "pig tails" riveted to the box. Receptacles shall be grounded with a conductor connected to the ground terminal. Use of the yoke to box connection is not acceptable.

3.2 Feeders: In all raceways provide bare grounding conductors bonded to source enclosures, pull boxes, junction boxes and branch panel grounding busses. Insulated conductors may be used provided that all visible portions of the insulation are wrapped with green vinyl tape, half-lapped.

3.3 Branch Circuits: In all raceways provide insulated ground bonded to outlet, pull, switch and junction boxes, standard grounding type receptacles, motor and appliance disconnects, motor starters, lighting fixtures, etc., and branch panel grounding busses.

3.4 Grounding conductors sizes: shall comply with Table 250-95 of the N.E.C.

END OF SECTION 16450

SECTION 16470 - PANELBOARDS - CIRCUIT BREAKER TYPE

PART 1 GENERAL:

1.1 Standards: Federal Specifications W-P-115 (current issue), Type I, Class 1. Panels shall be UL-listed and labeled.

PART 2 MATERIALS:

2.1 Branches: Plug-in or bolt-in type circuit breakers. Contacts: quick-make and quick-break for both manual and automatic operation. Trip units: Thermal overload and magnetic short circuit type. Multi-pole breakers: Common trip with single or tied handles. Interrupting ratings: As indicated on the drawings, with 10,000 amperes minimum.

2.2 Busses: Copper or tin plated aluminum.

2.3 Ground Bus: Copper bar with set-screw lugs for feeder and branch circuit equipment grounding conductors. Bus shall be factory bonded to enclosure.

2.4 Doors: Provide metal latch with pin tumbler keyed lock, Yale No. 511S with rosette sleeve, or equal. Plastic latch handles are not acceptable.

2.5 Doors and Exterior Trim: "Galvaneal" annealed steel, concealed mounting bolts and hinges, full finished with rust-inhibiting primer and baked gray enamel finish. Minimum 14 gage up to 44 cabinet height and 12 gage for taller cabinets.

2.6 Cabinets: Galvanized steel, 14 gage minimum, removable end plates, 20-inch minimum width.

2.7 Panel Labels shall be mounted on the interior trim as noted in Section 16001.

2.8 Breaker Labels shall be engraved plastic or metal types, clipped into the panel trim. Glued-on paper or plastic labels are not acceptable.

2.9 Provide metal-framed plastic enclosures on the inside of the doors for panel directories.

2.10 Provide panelboard accessories and devices as recommended by panelboard manufacturer in ratings and sizes for type of applications indicated.

PART 3 EXECUTION:

3.1 Shop drawings shall be prepared and submitted and approved prior to assembly. These shall include all dimensions, lug arrangements, breaker sizes, number of poles, ratings, positions, etc. Breakers shall be indicated pictorially and shall be numbered as noted on the drawings, by circuits, not pole numbers.

3.2 Install panelboards as indicated, in accord with manufacturer's written instructions, N.E.C. and NECA's "Standard of Installation".

3.3 Anchor panelboards tightly to walls and structural surfaces, insuring that they are mechanically secure and permanently affixed.

3.4 Provide electrical connections within enclosures.

3.5 Conductors shall be neatly cabled in the gutters, "squared-off" and excess lengths cut off.

Conductors shall be cabled with "Tyraps" or equal. Prior to permanently installing the doors and trim, each shall be individually approved by the Engineer.

3.6 Service lugs and bus taps shall be retorqued after completion of the conductor installation to comply with the manufacturer's specifications. All branch circuit lugs shall be tightened to the manufacturer's specifications.

3.7 Install typewritten circuit directories specific as to rooms/areas served and type of loads, such as: "Rooms 23, 25 - Lighting", "Classroom 16 - Kiln" or "Office 24 - Receptacles". Circuits supplying battery back-up emergency fixtures or exit lights shall have "Emergency" notation in addition to the rooms/devices served.

3.8 Test panelboards to demonstrate capability and compliance with requirements. Field-correct malfunctioning items, or replace where not field correctable.

END OF SECTION 16470

SECTION 16475 - OVERCURRENT PROTECTION DEVICES

PART 1 GENERAL:

1.1 N.E.C. Compliance: Comply with N.E.C. requirements pertaining to overcurrent protective devices in Articles 240, 384, 430, 445 and 450 as applicable to this project.

1.2 UL Compliance and Labeling: The following devices shall comply with the applicable UL standards and shall be so listed:

1.3 Circuit breakers, UL 489, "Molded-Case Circuit Breakers and Circuit Breaker Enclosures".

1.4 Fuses, UL 198, items as specified herein.

1.5 NEMA Compliance: Comply with NEMA Std. Pub. Nos. AB-1, AB-2 and SG-3 pertaining to molded-case and low-voltage power type circuit breakers.

1.6 Federal Specifications Compliance: Comply with W-C-375/GEN (current issue) pertaining to molded-case circuit breakers.

1.7 ANSI Compliance: Comply with ANSI C97.1 pertaining to low-voltage cartridge fuses.

PART 2 MATERIALS:

2.1 General: Except as otherwise indicated, provide fuses of types, sizes, ratings, average time/current and peak let-through current characteristics indicated which comply with manufacturer's standard design, materials and construction.

2.2 Provide UL Class RK-5, fast-acting, current-limiting fuses for feeders and loads not serving motors.

2.3 Provide UL Class RK-1, dual-element, current-limiting, time-delay fuses for protecting motors, motor branch circuits and motor feeders.

2.4 Provide other fuses with specific characteristics as indicated on the drawings.

2.5 Spare Fuse Cabinet: Bussmann "SFC" or approved equal, with metal framed, plastic cover inventory card holder mounted on the inside of the door.

PART 3 EXECUTION:

3.1 Final Fuse Selection: Ratings, types and sizes shall be determined at the completion of the project to suit the actual motor and other load characteristics. Final selections shall be approved by the Engineer.

3.2 Spare Fuses and Cabinet:

A. Install the cabinet at the location indicated on the drawings.
B. Provide a minimum of 10% spare fuses of each type, rating, characteristics, etc., but not less than three of each.
C. Install a typewritten inventory list in the card holder on the inside of the door.
D. Obtain a signed inventory receipt from the Owner for the fuses - and forward to O'Rouark Engineering - as required in Section 16001.
E. Lock the cabinet and deliver the key(s) to the Owner.

END OF SECTION 16475

SECTION 16510 - LIGHTING FIXTURES

PART 1 GENERAL:

1.1 Provide lighting fixtures, of sizes, types and ratings and ratings indicated; comprised of but not necessarily limited to, the following components: lamps, lampholders, reflectors, lenses, louvers, ballasts, starters, mounting hardware and brackets and internal wiring.

1.2 ANSI Compliance: Comply with applicable ANSI standards pertaining to lamp materials, lamp ballasts/transformers and lighting fixtures.

1.3 NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to lighting equipment.

1.4 CBM Labels: Fluorescent ballasts, as applicable, shall comply with CBM standards and carry the CBM label.

1.5 UL Labels: Provide lighting fixtures which have been UL-listed and labeled.

1.6 NFPA Compliance: Comply with N.E.C. (NFPA No. 70) as applicable to installation and construction of lighting fixtures.

PART 2 MATERIALS:

2.1 Fluorescent ballasts:

A. Unless noted otherwise, shall be rapid-start, high power factor, electronic, low-noise, energy-efficient with built-in overload (overheat) protection, ANSI GEB10 standards for harmonics.
B. Instant start ("IS") types shall be used for normal switching. Rapid start ("RS") types shall be used where automatic, motion sensing, controls are used
C. Approved brands: Advance, Magnetek and Sylvania. The respective, marked ballast catalog sheets shall be included in the fixture submittals.
D. Electronic ballasts shall be guaranteed for four years after the date of Substantial Completion.
E. Copies of the manufacturer's warranty shall be delivered to the Engineer for insertion into the electrical operation and maintenance manuals. Refer to section 16001 for other guarantee requirements and the *Electrical Project Completion Check List* requirements.

2.2 HID ballasts:

A. Unless otherwise noted, shall be high power factor, constant-wattage, low-noise.
B. High pressure sodium lamp ballasts shall have circuitry to allow six-month's operation on a failed lamp without damage to the ballast or its accessories.

2.3 Comply with added fixture and ballast requirements as contained in the "Lighting Fixture Schedule" on the drawings.

PART 3 EXECUTION:

3.1 Install lighting fixtures of types indicated on the the drawings and at indicated heights; in accordance with the lighting fixture manufacturer's written instructions and with recognized industry practices; to ensure that the fixtures comply with those requirements to serve the intended purposes. Comply with NEMA, N.E.C. and NECA's "Standard of Installation" pertaining to installation of lighting fixtures.

3.2 Fasten fixtures securely to structural support members of building. Provide solid, secure, PTFR wood blocking between wall studs and ceiling joists for surface mounted fixtures. Fixtures shall be fastened to the blocking, at 4'-0" centers (minimum), with screws penetrating the blocking at least 1 1/2". Fixtures weighing more than 50 pounds shall be fastened to the blocking with bolts entering the blocking from the top and extending into the fixture. Bolts shall be 3/16" minimum, with 1" washer on top of the blocking and a lock washer between the nut and fixture body. Supporting fixtures directly from wall and ceiling materials (gypsum board, etc.) is not acceptable. Check to ensure that fixtures are in straight rows and heights and pendant fixtures are plumb.

3.3 (Not used)

3.4 Clean fixtures of dirt, dust and debris prior to the date of final acceptance.

3.5 Upon completion of installation of lighting fixtures and after the building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

3.6 Mark the neck of HID lamps with a heat resistant ink to indicate month and year of installation.

3.7 At date of substantial completion replace defective lamps and those noticeably dimmed after Contractor's use and testing, as judged by the Architect or Engineer.

3.8 Spare Lamps:

A. Furnish a stock of replacement lamps amounting to 10% of the total lamps of each size and type used on this project, but not less than one standard carton as packaged by the lamp manufacturer.

B. Deliver the lamps, in substantial cartons, to the Owner's storage and obtain and submit a receipt for same, as noted in Section 16001, for the items delivered. On the exterior of each carton provide lettering to indicate the type(s) of fixtures in which each type or size of lamp are used.

3.9 Refer to Division-1 sections regarding replacement/restoration of lamps in lighting fixtures, where used for temporary lighting prior to date of substantial completion.

3.10 Refer to Section 16001 regarding guarantee and replacement of lamps.

END OF SECTION 16510

SECTION 16720 - COMMUNICATION SYSTEMS

PART 1 GENERAL:

1.1 For telephone:

A. Provide raceways, pull wires and outlet boxes.

B. The Owner will supply, install and connect cables, receptacles, terminals, etc.

1.2 Refer to Section 16003 for the scope of work to provide telephone service to the building.

PART 2 MATERIALS:

2.1 Raceways shall be as specified, elsewhere in this division, for branch circuit electrical wiring.

2.2 Outlets shall be a 4" square box, with extension rings, fittings, receptacles, cover plates, etc.

PART 3 EXECUTION:

3.1 Empty raceways shall have a No. 14 galvanized steel pull wire in each run.

END OF SECTION 16720

Council Maintenance Yard
BLDG 31601
January 2005

Phase IV Foundation Investigation Report

250.01 INTRODUCTION

The purpose of this report is to provide subsurface information and recommendations for the design and construction of a new Maintenance Building (BLDG 31601) for the Council Maintenance Yard. The project site is located to the west of Highway 95 about 4 miles south of Council Idaho at approximate Milepost 132.3 A vicinity sketch is included in Appendix A.

In April of 2004, an 11.108-acre lot was purchased by the Idaho Transportation Department with the intent of building a four bay, drive-through building capable of storage and maintenance of snow removal equipment including snow plow trucks. The building will measure approximately 61 feet by 98 feet (5,978 square feet), including small office space and bathroom facilities. A sand shed (BLDG 31602), measuring approximately 140-foot by 60-foot, will also be installed at the project site for the protection of sand and salt stockpiles. While this report is meant to provide subsurface information and recommendations for the Maintenance Building, bore log data for the Sand Shed has been included to provide additional information about the project site.

Shallow foundations are recommended for supporting the structure of the new Maintenance Building.

Note: At the time of the field investigation, the native material at the project site had been cleared of vegetation and diced basalt rock had been hauled in from an outside source to level the project site and to provide a strong foundation for the new construction. As such, the bore logs show the diced basalt fill and contain relatively small amount of native material.

250.02 FIELD EXPLORATION AND LABORATORY TESTING

250.02.01 Borings/Test Pits

On October 28, 2004, the field exploration of the Council Maintenance Yard consisted of 8 backhoe test pits. There were 4 test pits for the new Maintenance Building and 4 test pits for the new Sand Shed. The test pits for the Sand Shed will be included in this report to provide additional information of the subsurface structure. The locations of the test pits are in the vicinity of the proposed site of each structure. A plan view showing the location of each backhoe test pit is included in Appendix B.

For the Maintenance Building, the depth of the backhoe test pits (BH #1 through BH #4) ranged from 1.5 feet to 7.2 feet below the surface elevation. For the Sand Shed, the depth of the backhoe test pits (BH #5 through BH #8) ranged from 1.0 feet to 7.0 feet below the surface elevation. Elevations, with reference to sea level, were not obtained for this field investigation. The bore log data for each backhoe test pit is shown in Appendix C.

250.02.02 Field Tests

Pocket penetrometer tests were performed in the layer of clay (CL) found in BH #2 and BH #3, at depths of 4.2 feet and 5.2 feet, respectively, below the surface elevation. Numerous basalt rocks were encountered during the field investigation; the largest rock was measured to be 1.8 feet in diameter. The results of the field tests can be found on the attached backhoe test pit logs (Appendix C).

250.02.03 Geophysical Exploration

No geophysical investigations were conducted during the investigation.

250.02.04 Laboratory Tests

No laboratory tests were performed.

250.03 SURFACE CONDITIONS

All forms of vegetation at the project site had been cleared at the time of the field investigation for the purpose of preparing the site for construction. The dominant forms of vegetation at the areas adjacent to the proposed project site consist of sage brush and grasses. The surface materials consist of diced basalt with some clay (GC) and diced basalt (RK).

250.04 SUBSURFACE CONDITIONS

The subsurface materials consisted of diced basalt with some clay (GC) and diced basalt (RK) to at least the depth of the test pit. In 5 of the 8 test pits, the diced basalt (RK) resulted in backhoe refusal. Excavation in rock will be required. The only other material encountered was found in BH #2 and BH #3, where a 1.8 to 2.8 foot layer of clay (CL) was encountered between layers of diced basalt (GC or RK). Ground water was not encountered at the time of the investigation (October 28, 2004). The backhoe test pit logs can be found in Appendix C.

250.05 CONCLUSIONS AND RECOMMENDATIONS

250.05.01 General

Shallow foundations are recommended for the new Maintenance building.

250.05.02.01 Spread Footings

The District 3 Materials recommends the installation of spread footings, $\geq$ 3 feet, to support the structure. The frost line is approximately 36" below the soil surface, therefore the spread footings should be placed at least 3.0' below the existing ground. If clay is present, the soil should be overexcavated a minimum of 2 feet below the footing elevation or to the bottom of the clay layer (whichever is smaller), then backfilled to the original footing depth with compacted ¾" aggregate base or granular subbase. The width dimensions of the backfill

material should be at least one and one-half times the width of the footing. Backfill materials should be with granular subbase, ¾" aggregate base or lean concrete and Class A compaction should be utilized.

The following parameters are given for square or rectangular footings placed on the existing fill or granular backfill. The allowable bearing capacity of 5.0 ksf can be used to design footings with widths between 3 and 6 feet. The coefficient of friction between the footing bottom and the engineered backfill or fractured basalt rock is estimated at 0.43. The active equivalent fluid pressure estimated around the footing for the granular material is estimated at 35 pcf, the at rest equivalent fluid pressure is estimated at 55 pcf, and the passive equivalent fluid pressures is estimated at 445 pcf.

The following estimated soil engineering properties are recommended for the foundation design:

Foundation Soil Type	fractured basalt rock with clay seams (RK)	granular material
Unit Weight (dry)	140 pcf (Est.)	125 pcf
Friction Angle	35 degrees	35 degrees
Cohesion	0 Pa	0 Pa
Allowable Bearing	6.0 ksf	5.0 ksf
Coefficient of friction	0.43	0.47
Coefficient of Lateral Subgrade Reaction	90 pci	90 pci
Allowable settlement	1.0 inch	1.0 inch

250.05.03 Lateral Pressure and Backfill

Backfill and leveling course material shall consist of granular material with an estimated unit weight of 125 pcf and a friction angle of 35 degrees. The active equivalent fluid pressure estimated for the fill will be 35 pcf, the at rest equivalent fluid pressure will be 55 pcf, and the passive equivalent fluid pressures will be 445 pcf.

250.05.04 Anchors

Anchors are not needed for this project.

250.05.05 Drainage

If clay is present under the footings, perforated pipe or trenches backfilled with granular material should be utilized to provide adequate drainage of storm water buildup. The drainage system should be located under the footings and should be designed to provide positive drainage. The pipe or trench should daylight some distance away from the building in an area free of traffic and other hazards. The outlet should be placed in an area where the water can easily dissipate into the soil. Trench backfill shall consist of free draining granular material.

ITD-500 09-94

IDAHO TRANSPORTATION DEPARTMENT

Department Memorandum

DATE: JANUARY 24, 2005

PROJECT NO.(S):

TO: MATERIALS ENGINEER

KEY NO.(S): BLDG 31601

FROM: THOMAS A. POINTS P.E.
DISTRICT 3 MATERIALS ENGINEER

Project Identification, County, Etc.:
COUNCIL MTCE BLDG, WEST OF US-95, ADAMS COUNTY

RE: PHASE IV FOUNDATION INVESTIGATION REPORT

Attached is the Phase IV Report for this project. Your review is appreciated.

ATTACHMENT

TAP:KN:TH:th

cc: MTLS ENGR (w/ attach-2 copies)
ADE(E)-3
PDE-3
MTLS E-3 (w/ attach-1 copy)
ADE(O)-3

RECEIVED
FEB 02 2005
MATERIALS

Council Maintenance Yard
BLDG 31601
January 2005

Phase IV Foundation Investigation Report

250.01 INTRODUCTION

The purpose of this report is to provide subsurface information and recommendations for the design and construction of a new Maintenance Building (BLDG 31601) for the Council Maintenance Yard. The project site is located to the west of Highway 95 about 4 miles south of Council Idaho at approximate Milepost 132.3 A vicinity sketch is included in Appendix A.

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Shallow foundations are recommended for supporting the structure of the new Maintenance Building.

Note: At the time of the field investigation, the native material at the project site had been cleared of vegetation and diced basalt rock had been hauled in from an outside source to level the project site and to provide a strong foundation for the new construction. As such, the bore logs show the diced basalt fill and contain relatively small amount of native material.

250.02 FIELD EXPLORATION AND LABORATORY TESTING

250.02.01 Borings/Test Pits

On October 28, 2004, the field exploration of the Council Maintenance Yard consisted of 8 backhoe test pits. There were 4 test pits for the new Maintenance Building and 4 test pits for the new Sand Shed. The test pits for the Sand Shed will be included in this report to provide additional information of the subsurface structure. The locations of the test pits are in the vicinity of the proposed site of each structure. A plan view showing the location of each backhoe test pit is included in Appendix B.

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250.02.02 Field Tests

Pocket penetrometer tests were performed in the layer of clay (CL) found in BH #2 and BH #3, at depths of 4.2 feet and 5.2 feet, respectively, below the surface elevation. Numerous basalt rocks were encountered during the field investigation; the largest rock was measured to be 1.8 feet in diameter. The results of the field tests can be found on the attached backhoe test pit logs (Appendix C).

250.02.03 Geophysical Exploration

No geophysical investigations were conducted during the investigation.

250.02.04 Laboratory Tests

No laboratory tests were performed.

250.03 SURFACE CONDITIONS

All forms of vegetation at the project site had been cleared at the time of the field investigation for the purpose of preparing the site for construction. The dominant forms of vegetation at the areas adjacent to the proposed project site consist of sage brush and grasses. The surface materials consist of diced basalt with some clay (GC) and diced basalt (RK).

250.04 SUBSURFACE CONDITIONS

The subsurface materials consisted of diced basalt with some clay (GC) and diced basalt (RK) to at least the depth of the test pit. In 5 of the 8 test pits, the diced basalt (RK) resulted in backhoe refusal. Excavation in rock will be required. The only other material encountered was found in BH #2 and BH #3, where a 1.8 to 2.8 foot layer of clay (CL) was encountered between layers of diced basalt (GC or RK). Ground water was not encountered at the time of the investigation (October 28, 2004). The backhoe test pit logs can be found in Appendix C.

250.05 CONCLUSIONS AND RECOMMENDATIONS

250.05.01 General

Shallow foundations are recommended for the new Maintenance building.

250.05.02.01 Spread Footings

The District 3 Materials recommends the installation of spread footings, $\geq$ 3 feet, to support the structure. The frost line is approximately 36" below the soil surface, therefore the spread footings should be placed at least 3.0' below the existing ground. If clay is present, the soil should be overexcavated a minimum of 2 feet below the footing elevation or to the bottom of the clay layer (whichever is smaller), then backfilled to the original footing depth with compacted ¾" aggregate base or granular subbase. The width dimensions of the backfill

material should be at least one and one-half times the width of the footing. Backfill materials should be with granular subbase, ¾" aggregate base or lean concrete and Class A compaction should be utilized.

The following parameters are given for square or rectangular footings placed on the existing fill or granular backfill. The allowable bearing capacity of 5.0 ksf can be used to design footings with widths between 3 and 6 feet. The coefficient of friction between the footing bottom and the engineered backfill or fractured basalt rock is estimated at 0.43. The active equivalent fluid pressure estimated around the footing for the granular material is estimated at 35 pcf, the at rest equivalent fluid pressure is estimated at 55 pcf, and the passive equivalent fluid pressures is estimated at 445 pcf.

The following estimated soil engineering properties are recommended for the foundation design:

Foundation Soil Type	fractured basalt rock with clay seams (RK)	granular material
Unit Weight (dry)	140 pcf (Est.)	125 pcf
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Coefficient of Lateral Subgrade Reaction	90 pci	90 pci
Allowable settlement	1.0 inch	1.0 inch

250.05.03 Lateral Pressure and Backfill

Backfill and leveling course material shall consist of granular material with an estimated unit weight of 125 pcf and a friction angle of 35 degrees. The active equivalent fluid pressure estimated for the fill will be 35 pcf, the at rest equivalent fluid pressure will be 55 pcf, and the passive equivalent fluid pressures will be 445 pcf.

250.05.04 Anchors

Anchors are not needed for this project.

250.05.05 Drainage

If clay is present under the footings, perforated pipe or trenches backfilled with granular material should be utilized to provide adequate drainage of storm water buildup. The drainage system should be located under the footings and should be designed to provide positive drainage. The pipe or trench should daylight some distance away from the building in an area free of traffic and other hazards. The outlet should be placed in an area where the water can easily dissipate into the soil. Trench backfill shall consist of free draining granular material.

It is recommended to encase the trench in geotextile to prevent blockage by fine grained soils. The geotextile shall function for subgrade separation and drainage. The geotextile shall be Drainable and Non-woven with the strength of a Subgrade Separation Geotextile Type II per Subsection 718.07 and with the Permittivity and AOS of Subsection 718.05-Drainage Geotextile.

250.05.06 Embankments

A leveling course, consisting of granular material, shall be utilized to prepare the building site for construction. Compaction should be Class A and the settlement of the granular material will be minimal and immediate. Finished grade should be sloped away from the footings.

250.05.07 Erosion Control

Surface drainage should be directed and controlled on site.

250.05.08 Seismic Design

Design peak velocity-related acceleration coefficient, 10% probability exceedance in 50 years, for structure site is 0.13 A_v (Materials Manual Figure 250.05.08-1). The project falls approximately within the $A \leq 0.07$ contour of the Effective Peak Firm Ground Acceleration map (Materials Manual Figure 250.05.08-2). No active major faults are known to exist in the area.

250.05.09 Construction

Excavation in fractured basalt rock will be required. Rock blasting may be required.

250.06 APPENDICES

Appendix A: Vicinity Sketch

Appendix B: Plan View of Backhoe Test Pit Locations

Appendix C: Backhoe Test Pit Field Logs

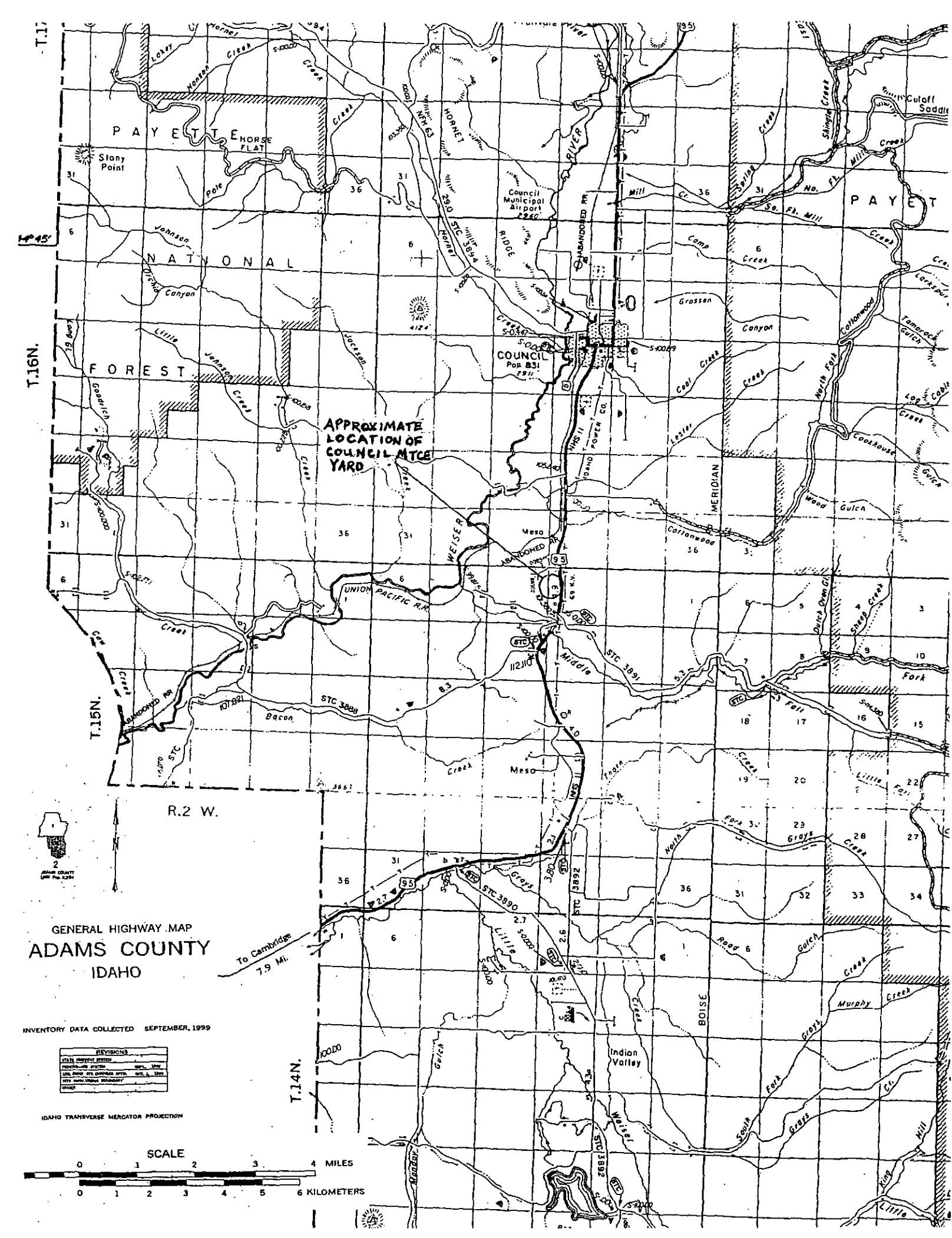
250.07 FOUNDATION INVESTIGATION PLAT

A foundation investigation plat was not prepared for this project.

250.08 REFERENCES

ITD Materials Manual Section 250.00

APPENDIX A
VICINITY SKETCH



GENERAL HIGHWAY MAP

ADAMS COUNTY

IDAHO

INVENTORY DATA COLLECTED SEPTEMBER, 1999

REVISIONS	
STATE HIGHWAY SYSTEM	
FEDERAL-AID SYSTEM	1991, 1999
LOCAL ROAD SYS CHANGES AFFG.	OCT. 1, 1999
CITY AND/OR URBAN BOUNDARY	
OTHER	

IDAHO TRANSVERSE MERCATOR PROJECTION

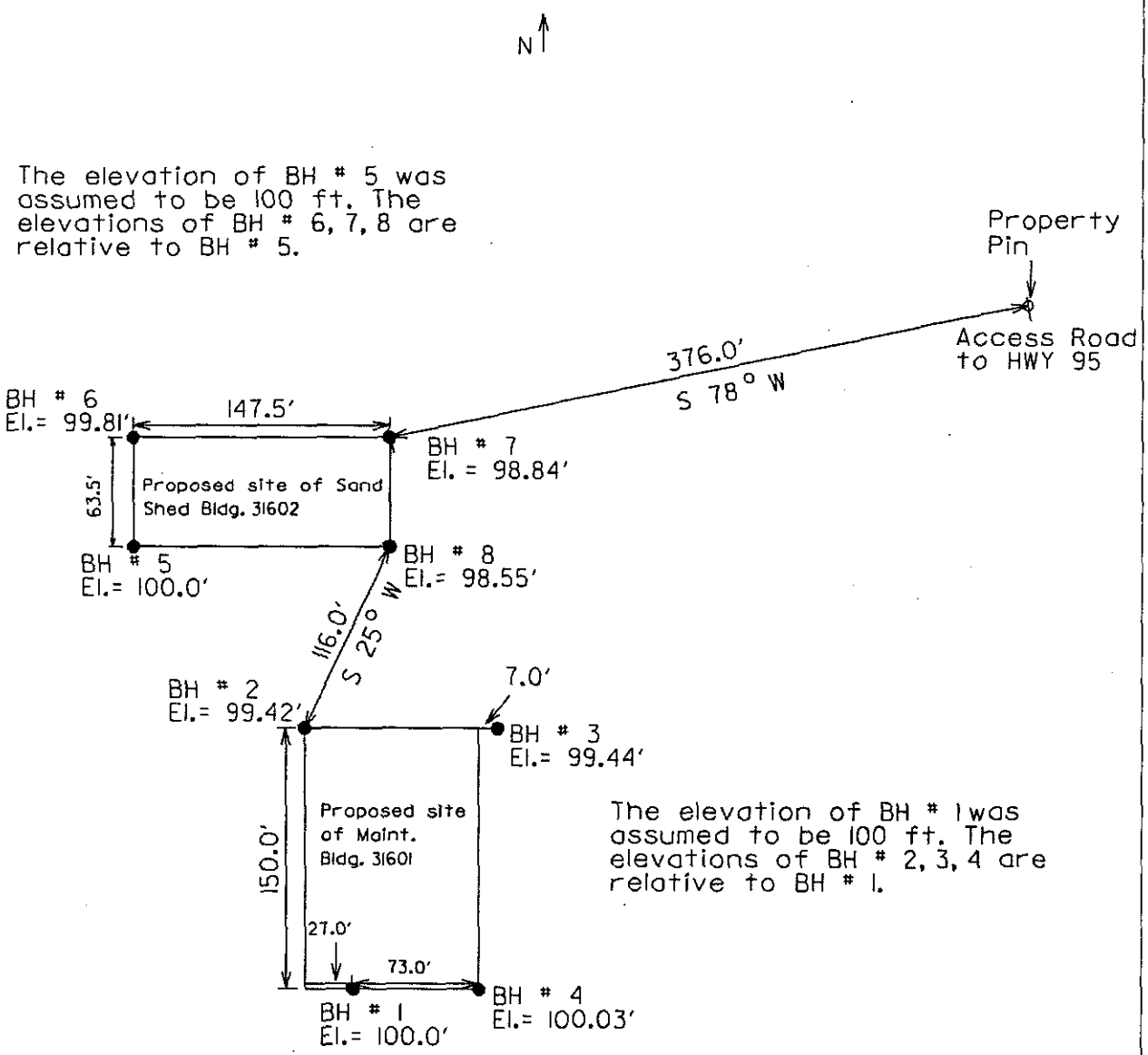
SCALE

0 1 2 3 4 MILES

0 1 2 3 4 5 6 KILOMETERS

APPENDIX B
PLAN VIEW OF
BACKHOE TEST PIT LOCATIONS

Council Maintenance Bldg. 31601
Council Sand Shed Bldg. 31602
01/24/05



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APPENDIX C
BACKHOE TEST PIT FIELD LOGS

FOUNDATION AND SLOPE STABILITY EXPLORATION

Field Log of Boring No. BH # 1 Sheet 1 of 1

Project No. Bldg. # 31601 Date 10-27-04 Collar Elevation

Project Name Council Maint. Bldg. Reference South West Corner

Technician S. Hyde Location

Driller J. DeBerry Water Level After

Drilling Method Backhoe Driving Weight Average Drop

Geologist K. Nottingham Time: Start Stop

SAMPLE

Type	Number	Depth	Blows per Lenght - in.	Moisture	Consistency	Color	Description	Group Symbol	Remarks
		0		M		Dark Brn	0.0' - 0.9' Diced Basalt with moist Clay.	GC	
		1		SM		Brn	0.9'-1.5' Diced Basalt Max size rocks found = 1.5'. Refusal 1.5'.	RK	
		2							
		3							
		4							
		5							
		6							
		7							
		8							
		9							
		10							

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FOUNDATION AND SLOPE STABILITY EXPLORATION

Field Log of Boring No. BH # 2 Sheet 1 of 1

Project No. Bldg. # 31601 Date 10-27-04 Collar Elevation

Project Name Council Maint. Bldg. Reference North West Corner

Technician S. Hyde Location 0.58' Lower than BH # 1

Driller J. DeBerry Water Level After

Drilling Method Backhoe Driving Weight Average Drop

Geologist K. Nottingham Time: Start Stop

SAMPLE Type	Number	Depth	Blows per Lenght - in.	Moisture	Consistency	Color	Description	Group Symbol	Remarks
				M		Dark Brn	0.0' - 3.6' Diced Basalt with moist Clay. Max size rock found = 1.3'.	GC	
				SM		Lt. Brn	3.6' - 5.4' Clay with a few small rocks < 3".	CL	Pocket Penetrometer Test @ 4.2' = 4.5 Tons/ft²
							5.4'-5.9' Diced Basalt with some Clay. Refusal 5.9'.	RK	

0 1 2 3 4 5 6 7 8 9 10

FOUNDATION AND SLOPE STABILITY EXPLORATION

Field Log of Boring No. BH # 3 Sheet 1 of 1

Project No. Bldg. # 31601 Date 10-28-04 Collar Elevation

Project Name Council Maint. Bldg. Reference North East Corner

Technician S. Hyde Location 0.56' Lower than BH # 1

Driller J. DeBerry Water Level After

Drilling Method Backhoe Driving Weight Average Drop

Geologist K. Nottingham Time: Start Stop

SAMPLE

Type	Number	Depth	Blows per Lenght - in.	Moisture	Consistency	Color	Description	Group Symbol	Remarks
						Brn	0.0'-1.6' Diced Basalt Max size rock found = 1.3'.	RK	
						Dark Brn	1.6' - 3.7' Diced Basalt with moist Clay.	GC	
						Lt. Brn	3.7' - 6.5' Clay with a few small rocks < 3".	CL	Pocket Penetrometer Test @ 5.2' = 3.5 Tons/ft^2
						Dark Brn	6.5'-7.2' Diced Basalt Max size rock found = 1.2'. B.O.H. 7.2'.	RK	

0 1 2 3 4 5 6 7 8 9 10

FOUNDATION AND SLOPE STABILITY EXPLORATION

Field Log of Boring No. BH # 4 Sheet 1 of 1

Project No. Bldg. # 31601 Date 10-28-04 Collar Elevation

Project Name Council Maint. Bldg. Reference South East Corner

Technician S. Hyde Location 0.03' Higher than BH # 1

Driller J. DeBerry Water Level After

Drilling Method Backhoe Driving Weight Average Drop

Geologist K. Nottingham Time: Start Stop

SAMPLE

Type	Number	Depth	Blows per Lenght - in.	Moisture	Consistency	Color	Description	Group Symbol	Remarks
				Moist		Dark Brn	0.0'-1.2' Diced Basalt Clayey.	GC	
				SM		Dark Brn	1.2'-3.5' Diced Basalt Max size rock found = 1.8'.	RK	
							B.O.H. 3.5'. Refusal		

0 1 2 3 4 5 6 7 8 9 10

FOUNDATION AND SLOPE STABILITY EXPLORATION

Field Log of Boring No. BH # 5 Sheet 1 of 1

Project No. Bldg. # 31602 Date 10-28-04 Collar Elevation

Project Name Council Sand Shed Reference South West Corner

Technician S. Hyde Location

Driller J. DeBerry Water Level After

Drilling Method Backhoe Driving Weight Average Drop

Geologist K. Nottingham Time: Start Stop

SAMPLE

Type	Number	Depth	Blows per Lenght - in.	Moisture	Consistency	Color	Description	Group Symbol	Remarks
						Dark Brn	0.0'-7.0' Diced Basalt Max size rock found = 1.7'.	RK	
							B.O.H. 7.0'.		

0 1 2 3 4 5 6 7 8 9 10

FOUNDATION AND SLOPE STABILITY EXPLORATION

Field Log of Boring No. BH * 6 Sheet 1 of 1

Project No. Bldg. * 31602 Date 10-28-04 Collar Elevation

Project Name Council Sand Shed Reference North West Corner

Technician S. Hyde Location 0.19' Lower than BH * 5

Driller J. DeBerry Water Level After

Drilling Method Backhoe Driving Weight Average Drop

Geologist K. Nottingham Time: Start Stop

SAMPLE

Type	Number	Depth	Blows per Lenght - in.	Moisture	Consistency	Color	Description	Group Symbol	Remarks
		0		M		Dark Brn	0.0'-1.0' Diced Basalt Clayey.	GC	
		1				Dark Brn	1.0' Diced Basalt Refusal.	RK	
		2							
		3							
		4							
		5							
		6							
		7							
		8							
		9							
		10							

FOUNDATION AND SLOPE STABILITY EXPLORATION

Field Log of Boring No. BH • 7 Sheet 1 of 1

Project No. Bldg. • 31602 Date 10-28-04 Collar Elevation

Project Name Council Maint. Bldg. Reference North East Corner

Technician S. Hyde Location 1.16' Lower than BH • 5

Driller J. DeBerry Water Level After

Drilling Method Backhoe Driving Weight Average Drop

Geologist K. Nottingham Time: Start Stop

SAMPLE

0	Type	Number	Depth	Blows per Lenght - in.	Moisture	Consistency	Color	Description	Group Symbol	Remarks
0					M		Dark Brn	0.0'-5.5' Diced Basalt Clayey. Max size rock found = 1.3'.	GC	
1										
2										
3										
4										
5										
6								B.O.H. 5.5'.		
7										
8										
9										
10										

FOUNDATION AND SLOPE STABILITY EXPLORATION

Field Log of Boring No. BH = 8 Sheet 1 of 1

Project No. Bldg. = 31602 Date 10-28-04 Collar Elevation

Project Name Council Sand Shed Reference South East Corner

Technician S. Hyde Location 1.45' Lower than BH = 5

Driller J. DeBerry Water Level After

Drilling Method Backhoe Driving Weight Average Drop

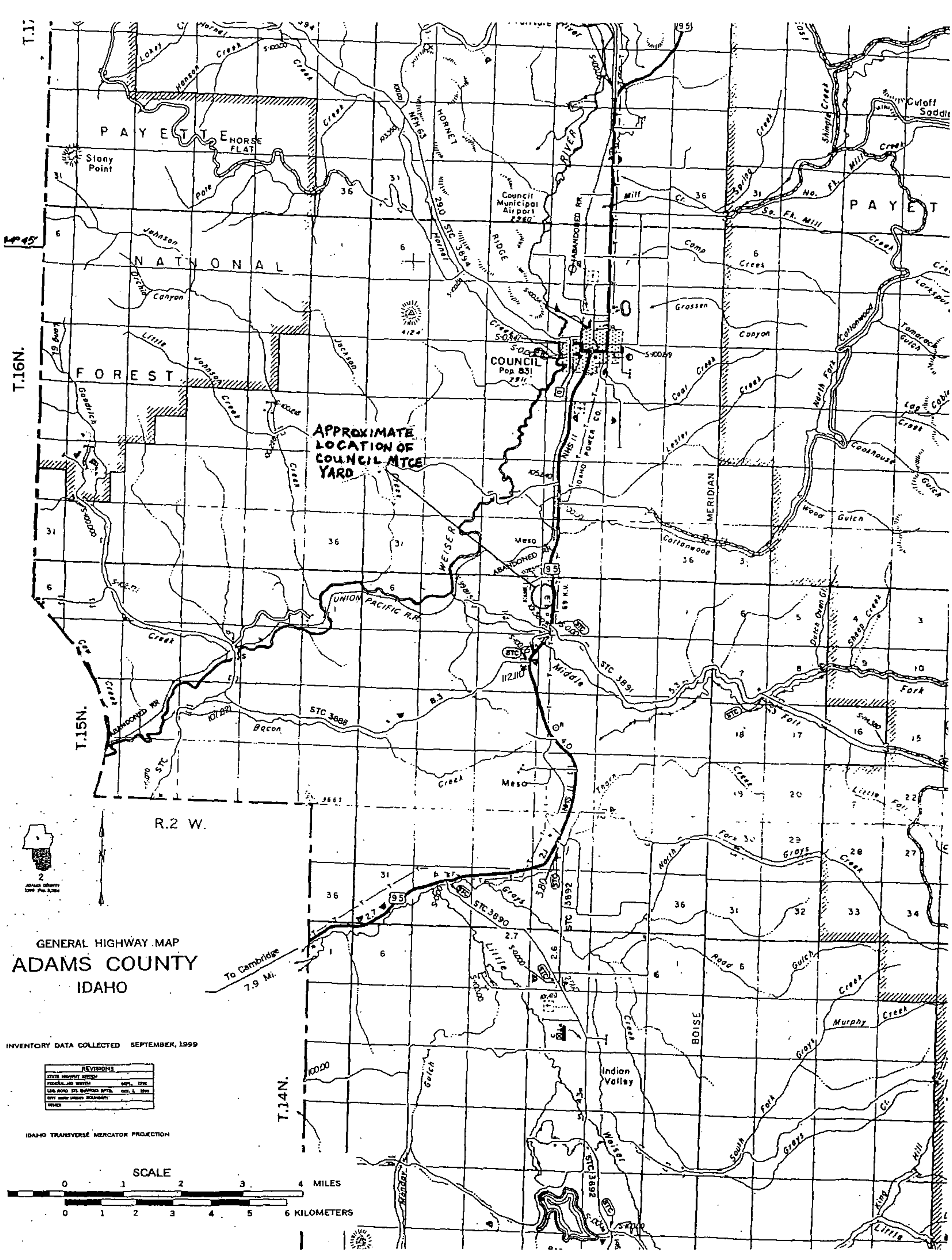
Geologist K. Nottingham Time: Start Stop

SAMPLE

Type	Number	Depth	Blows per Lenght - in.	Moisture	Consistency	Color	Description	Group Symbol	Remarks
				M		Dark Brn	0.0'-4.5' Diced Basalt Clayey. Max size rock found = 1.4'.	GC	
						Dark Brn	4.5'-5.7' Diced Basalt	RK	
							B.O.H. 5.7' Refusal.		

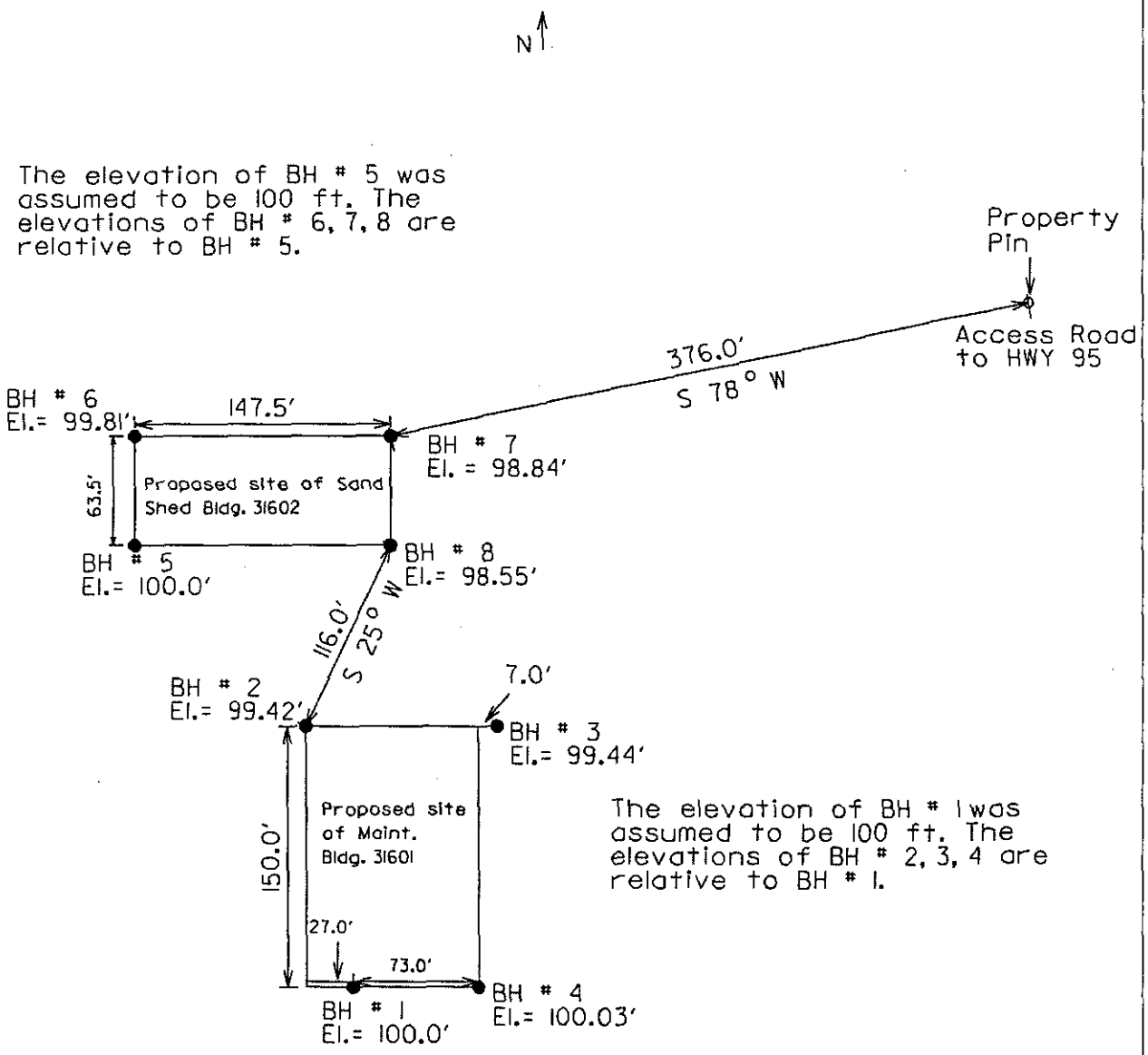
0 1 2 3 4 5 6 7 8 9 10

APPENDIX A
VICINITY SKETCH


GENERAL HIGHWAY MAP
ADAMS COUNTY
IDAHO
INVENTORY DATA COLLECTED SEPTEMBER, 1999
REVISIONS
IDAHO TRANSVERSE MERCATOR PROJECTION
SCALE
0 1 2 3 4 MILES
0 1 2 3 4 5 6 KILOMETERS
APPROXIMATE LOCATION OF COUNCIL MTCE YARD
COUNCIL
Pop. 831
PAYETTE
NATIONAL
FOREST
HORSE FLAT
Stony Point
Council Municipal Airport
HORNET RIDGE
WEISER RIVER
UNION PACIFIC R.R.
ABANDONED RR
IDAHO POWER CO.
MERIDIAN
BOISE
Meso
Indian Valley
To Cambridge 7.9 Mi.
T.16N.
T.15N.
T.14N.
R.2 W.
STC 3894
STC 3891
STC 3888
STC 3890
STC 3892
NFH 63
NHS 11
95
Johnson
Canyon
Little Johnson Creek
Jackson
Hornet Creek
Mill Cr.
So. Fk. Mill
No. Fk. Mill
Spring Creek
Shingle Creek
Camp Creek
Grossen Canyon
Cool Creek
Lester Creek
Cottonwood
North Fork
Cookhouse Gulch
Wood Gulch
Middle Fork
Dutch Oven Gl.
Sheep Creek
Bacon Creek
Cow Creek
Goodrich
Thorn Creek
Little Fall
North Fork
Grays Creek
Road Gulch
Murphy Creek
Grays Creek
South Fork
Grays Cr.
King Hill
Little
Weiser
Gulch
Cutoff Saddle
Pole Creek
Hanson Creek
Lakey
Tamarack Gulch
Larkspur
Log Cabin Creek

APPENDIX B
PLAN VIEW OF
BACKHOE TEST PIT LOCATIONS

Council Maintenance Bldg. 31601
Council Sand Shed Bldg. 31602
01/24/05



APPENDIX C
BACKHOE TEST PIT FIELD LOGS

FOUNDATION AND SLOPE STABILITY EXPLORATION

Field Log of Boring No. BH # 1 Sheet 1 of 1

Project No. Bldg. # 31601 Date 10-27-04 Collar Elevation

Project Name Council Maint. Bldg. Reference South West Corner

Technician S. Hyde Location

Driller J. DeBerry Water Level After

Drilling Method Backhoe Driving Weight Average Drop

Geologist K. Nottingham Time: Start Stop

SAMPLE

Type	Number	Depth	Blows per Lenght - in.	Moisture	Consistency	Color	Description	Group Symbol	Remarks
				M		Dark Brn	0.0' - 0.9' Diced Basalt with moist Clay.	GC	
				SM		Brn	0.9'-1.5' Diced Basalt Max size rocks found = 1.5'. Refusal 1.5'.	RK	

0 1 2 3 4 5 6 7 8 9 10

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FOUNDATION AND SLOPE STABILITY EXPLORATION

Field Log of Boring No. BH # 2 Sheet 1 of 1

Project No. Bldg. # 31601 Date 10-27-04 Collar Elevation

Project Name Council Maint. Bldg. Reference North West Corner

Technician S. Hyde Location 0.58' Lower than BH # 1

Driller J. DeBerry Water Level After

Drilling Method Backhoe Driving Weight Average Drop

Geologist K. Nottingham Time: Start Stop

SAMPLE

Type	Number	Depth	Blows per Lenght - in.	Moisture	Consistency	Color	Description	Group Symbol	Remarks
				M		Dark Brn	0.0' - 3.6' Diced Basalt with moist Clay. Max size rock found = 1.3'.	GC	
				SM		Lt. Brn	3.6' - 5.4' Clay with a few small rocks < 3".	CL	Pocket Penetrometer Test @ 4.2' = 4.5 Tons/ft²
							5.4'-5.9' Diced Basalt with some Clay. Refusal 5.9'.	RK	

0 1 2 3 4 5 6 7 8 9 10

FOUNDATION AND SLOPE STABILITY EXPLORATION

Field Log of Boring No. BH # 3 Sheet 1 of 1

Project No. Bldg. # 31601 Date 10-28-04 Collar Elevation

Project Name Council Maint. Bldg. Reference North East Corner

Technician S. Hyde Location 0.56' Lower than BH # 1

Driller J. DeBerry Water Level After

Drilling Method Backhoe Driving Weight Average Drop

Geologist K. Nottingham Time: Start Stop

SAMPLE Type	Number	Depth	Blows per Lenght - in.	Moisture	Consistency	Color	Description	Group Symbol	Remarks
		0				Brn	0.0'-1.6' Diced Basalt Max size rock found = 1.3'.	RK	
		1							
		2				Dark Brn	1.6' - 3.7' Diced Basalt with moist Clay.	GC	
		3							
		4				Lt. Brn	3.7' - 6.5' Clay with a few small rocks < 3".	CL	Pocket Penetrometer Test @ 5.2' = 3.5 Tons/ft²
		5							
		6							
		7				Dark Brn	6.5'-7.2' Diced Basalt Max size rock found = 1.2'. B.O.H. 7.2'.	RK	
		8							
		9							
		10							

FOUNDATION AND SLOPE STABILITY EXPLORATION

Field Log of Boring No. BH # 4 Sheet 1 of 1

Project No. Bldg. # 31601 Date 10-28-04 Collar Elevation

Project Name Council Maint. Bldg. Reference South East Corner

Technician S. Hyde Location 0.03' Higher than BH # 1

Driller J. DeBerry Water Level After

Drilling Method Backhoe Driving Weight Average Drop

Geologist K. Nottingham Time: Start Stop

SAMPLE

Type	Number	Depth	Blows per Lenght - in.	Moisture	Consistency	Color	Description	Group Symbol	Remarks
		0		Moist		Dark Brn	0.0'-1.2' Diced Basalt Clayey.	GC	
		1		SM		Dark Brn	1.2'-3.5' Diced Basalt Max size rock found = 1.8'.	RK	
		2							
		3							
		4					B.O.H. 3.5'. Refusal		
		5							
		6							
		7							
		8							
		9							
		10							

FOUNDATION AND SLOPE STABILITY EXPLORATION

Field Log of Boring No. BH # 5 Sheet 1 of 1

Project No. Bldg. # 31602 Date 10-28-04 Collar Elevation

Project Name Council Sand Shed Reference South West Corner

Technician S. Hyde Location

Driller J. DeBerry Water Level After

Drilling Method Backhoe Driving Weight Average Drop

Geologist K. Nottingham Time: Start Stop

SAMPLE

Depth	Type	Number	Depth	Blows per Lenght - In.	Moisture	Consistency	Color	Description	Group Symbol	Remarks
0							Dark Brn	0.0'-7.0' Diced Basalt Max size rock found = 1.7'.	RK	
7								B.O.H. 7.0'.		

FOUNDATION AND SLOPE STABILITY EXPLORATION

Field Log of Boring No. BH # 6 Sheet 1 of 1

Project No. Bldg. # 31602 Date 10-28-04 Collar Elevation

Project Name Council Sand Shed Reference North West Corner

Technician S. Hyde Location 0.19' Lower than BH # 5

Driller J. DeBerry Water Level After

Drilling Method Backhoe Driving Weight Average Drop

Geologist K. Nottingham Time: Start Stop

SAMPLE

Type	Number	Depth	Blows per Lenght - in.	Moisture	Consistency	Color	Description	Group Symbol	Remarks
		0		M		Dark Brn	0.0'-1.0' Diced Basalt Clayey.	GC	
		1				Dark Brn	1.0' Diced Basalt Refusal.	RK	
		2							
		3							
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		10							

FOUNDATION AND SLOPE STABILITY EXPLORATION

Field Log of Boring No. BH # 7 Sheet 1 of 1

Project No. Bldg. # 31602 Date 10-28-04 Collar Elevation

Project Name Council Maint. Bldg. Reference North East Corner

Technician S. Hyde Location 1.16' Lower than BH # 5

Driller J. DeBerry Water Level After

Drilling Method Backhoe Driving Weight Average Drop

Geologist K. Nottingham Time: Start Stop

SAMPLE

Type	Number	Depth	Blows per Lenght - in.	Moisture	Consistency	Color	Description	Group Symbol	Remarks
				M		Dark Brn	0.0'-5.5' Diced Basalt Clayey. Max size rock found = 1.3'.	GC	
							B.O.H. 5.5'.		

0 1 2 3 4 5 6 7 8 9 10

FOUNDATION AND SLOPE STABILITY EXPLORATION

Field Log of Boring No. BH * 8 Sheet 1 of 1

Project No. Bldg. * 31602 Date 10-28-04 Collar Elevation

Project Name Council Sand Shed Reference South East Corner

Technician S. Hyde Location 1.45' Lower than BH * 5

Driller J. DeBerry Water Level After

Drilling Method Backhoe Driving Weight Average Drop

Geologist K. Nottingham Time: Start Stop

SAMPLE

Type	Number	Depth	Blows per Lenght - in.	Moisture	Consistency	Color	Description	Group Symbol	Remarks
				M		Dark Brn	0.0'-4.5' Diced Basalt Clayey. Max size rock found = 1.4'.	GC	
						Dark Brn	4.5'-5.7' Diced Basalt	RK	
							B.O.H. 5.7' Refusal.		

B I D S C H E D U L E

Each Bid item shall be filled in completely by the **Contractor** in the bid schedule, by indicating total dollars and cents under Unit Price and Total Cost. All costs, including hourly rates will be included here and will be fully burdened to include, but not limited to, wages, transportation, lodging, overheard, and per-diem. All figures shall be written in ink or typed. Penciled entries will not be accepted; bids will be considered irregular and rejected.

Requisition Number: K-267150 Contractor / Business Name: _____

"SP" ITEM NO.	UNIT	ITEM DESCRIPTION	UNIT PRICE
1	**1-EA**	**Design and Construction of a Rigid Steel Maintenance Building**	**$_____**
2	**1-EA**	**(OPTION 1) Design and Construction of a Rigid Steel Sand Shed**	**$_____**

TOTAL COST $ _____

"SP" ITEM NO.	UNIT	ITEM DESCRIPTION	UNIT PRICE
1	**1-EA**	**Design and Construction of a Rigid Steel Maintenance Building**	**$_____**
3	**1-EA**	**(OPTION 2) Design and Construction of a Fabric Covered Sand Shed**	**$_____**

TOTAL COST $_____

AWARD TO BE MADE ALL OR NONE FOR SP-1 AND OPTION 1 OR OPTION 2
STATE TO CHOOSE

ITD will select the option deemed to be in the best interest of the State, based on total cost of ownership over a pre-determined period of time.

This page MUST be returned with your BID Documents.

BID RESPONSE

TO: IDAHO TRANSPORTATION BOARD
Idaho Transportation Department
Division of Highways

In compliance with your invitation for bids to be received: **June 13, 2005 @ 5:00 P.M., and Opened on June 14, 2005 @ 9:00 A.M.** The undersigned certifies they have examined the location of work and/or materials sites, and has satisfied themselves as to the condition to be encountered, and that the plans, specifications, contract and method of payment for such work is understood. The undersigned hereby agrees to furnish all materials, equipment and labor for the Design and Construction of a Rigid Steel Maintenance Building and a Sand Shed at Council, per the specifications contained in Requisition Number **K-267150**.

On the acceptance of this bid for said work the undersigned will furnish the 100% Contract Performance and Payment Bonds with approved and sufficient surety within 10 days after the contract is presented for signature.

The bidder furthers agrees that if awarded the contract, work will be completed within **one hundred fifty (150) calendar days** after authority to proceed has been given. In conformity with and subject to such extensions as may be authorized by the terms of "Determination and Extension of Contract Time," Subsection 108.06 of the said Standard Specifications

Accompanying this bid response is a Bid Bond or Cashier's Check in the amount of five percent (5%) of the total amount bid.

By signing this bid response (P-3, A, B or C), the bidder being duly sworn states that the firm, association or corporation to whom this contract is to be awarded has not by or through any of its officers, partners, owners or any other person associated therewith, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with this highway project, and is not financially interested in or otherwise affiliated in a business way with any other bidder on this project.

B I D D E R ‘S S I G N A T U R E S R E Q U I R E D

TO BE EXECUTED BY **C O R P O R A T E** CONTRACTORS

Date _____, 2005

Name, Address and Phone Number of
Corporation: _____

_____

_____
Phone Number

Idaho Public Works Contractors License Number _____

Incorporated under the laws of the State of _____

Name & Address of President _____

Name & Address of Secretary _____

Name & Address of Treasurer _____

SIGNATURE

_____
President, Vice President, etc…

State of _____, County of _____ss

On this _____ day of _____, in the year _____, before

me _____, personally appeared _____,
(Notary Public)
known or identified to me to be the President or Vice President or Secretary or Assistant Secretary, of the corporation that executed the instrument or the person who executed the instrument on behalf of said corporation, and acknowledged to me that such corporation executed the same.

_____

Notary Public for _____

Residing at _____

My Commission Expires on:

_____

B I D D E R ‘S S I G N A T U R E S R E Q U I R E D

TO BE EXECUTED BY **P A R T N E R S H I P**

Date _____, 2005

Name, Address and Phone Number of Bidder:

_____

_____

_____
Phone Number

Idaho Public Works Contractors License Number_____

SIGNATURE:

_____ _____
(Name & Title, as “Partner”) Address

_____ _____
(Name & Title, as “Partner”) Address

_____ _____
(Name & Title, as “Partner”) Address

THIS MUST BE SIGNED BY AT LEAST ONE GENERAL PARTNER

State of _____, County of _____ss

On this _____ day of _____, in the year _____,

before me _____, personally appeared
(Notary Public)
_____, known or identified to me to be one

of the partners in the partnership of _____
(Partnership Name Signed to Instrument)

and the partner or one of the partners who subscribed said partnership name to the foregoing

instrument, and acknowledged to me that they executed the same in said partnership name.

_____

Notary Public For _____

Residing at _____

My Commission Expires on:

_____

B I D D E R ‘S S I G N A T U R E S R E Q U I R E D

TO BE EXECUTED BY **SOLE PROPRIETOR**

Date _____, 2005

Name, Address and Phone Number of Bidder:

_____

_____

_____
Phone Number

Idaho Public Works Contractors License Number_____

SIGNATURE:

_____ _____
(Name & Title, as “Owner”) Address

_____ _____
(Name & Title, as “Owner”) Address

State of _____. County of _____ss

On this _____ day of _____, in the year _____,

before me _____, personally appeared
(Notary Public)

_____, known or identified to me to be the

person whose name is subscribed to the within instrument, and acknowledged to me that

_____ executed the same.
(he/she/they)

_____

Notary Public For _____

Residing at _____

My Commission Expires on:

_____

SUBCONTRACT REQUIREMENTS

PLUMBING, ELECTRICAL, HEATING & AIR-CONDITIONING WORK ONLY

1. If the contractor intends to subcontract plumbing, heating, air-conditioning or electrical work, they must complete this form, giving the name, address, and Public Works Contractors License Number, for any and all Subcontractors who shall, in the event the Contractor secures the contract and subcontracts the plumbing, electrical, heating or air-conditioning work under the contract. Failure to complete this form as required shall render any such bid submitted by a contractor non-responsive and void.

2. Contractors not intending to subcontract any such work named in the preceding paragraph shall leave the appropriate spaces below blank or indicated by writing in the "work shall be" **none.**

3. Subcontractors named in accordance with the provisions of Paragraph 1 must possess an appropriate Idaho Public Works Contractors License issued by the State of Idaho Public Works Contractors State License Board covering the contract work classification in which the subcontractors is named.

4. The following are the names, addresses, and Public Works Contractors License Numbers, who shall do the following designated specialty, work under the prime and/or general contract should I/we be award the prime or general contract:

   a. Subcontractor for the **Plumbing** work shall be:

   _____, Residing at

   _____, Whose Idaho Public Works Contractor's

   License # is _____

   b. Subcontractor for the **Electrical** work shall be:

   _____, Residing at

   _____, Whose Idaho Public Works Contractor's

   License # is _____

   c. Subcontractor for the **HVAC** work shall be:

   _____, Residing at

   _____, Whose Idaho Public Works Contractor's

   License # is _____

NOTE: THIS PAGE MUST BE RETURNED WITH YOUR BID DOCUMENTS!

Added 3/19/04

SPECIAL PROVISIONS - STATE-AID

I. APPLICATION

These contract provisions shall apply to all work performed on the contract by the contractor with his own organization and with the assistance of workmen under his immediate superintendence and to all work performed on the contract by piece work, station work or by subcontract.

II. EMPLOYMENT LISTS, LABOR SELECTION, NON-DISCRIMINATION

A local public employment agency has been designated by the State to prepare the employment lists for the project.

All qualified unskilled labor shall be employed insofar as possible from lists furnished the contractor by the employment agency designated in the contract. The contractor may avail himself of the services of the employment agency for obtaining labor of the intermediate and skilled grade.

In the performance of this contract, within the limitations of Subsection 107.01 requiring employment of up to 95% Idaho residents, preference in employment shall be given to qualified honorably discharged Veterans of the United States Armed Forces.

During the performance of this contract, the contractor, for itself, its assignees and successors in interest (hereinafter referred to as the "Contractor"), agrees as follows:

1. Compliance with Regulations:
   The Contractor shall comply with the Regulations relative to nondiscrimination in federally assisted programs of the U.S. Department of Transportation, Title 49, Code of Federal Regulations, Part 21, as they may be amended from time to time, (hereinafter referred to as the "Regulations"), which are herein incorporated by reference and made a part of this contract.

2. Nondiscrimination:
   The Contractor, with regard to the work performed during the contract, shall not discriminate on the grounds of race, color, religion, sex or national origin in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The Contractor shall not participate either directly or indirectly in the discrimination prohibited by section 21.5 of the Regulations, including employment practices when the contract covers a program set forth in Appendix B of the Regulations.

3. Solicitations for Subcontracts, Including Procurements of Materials and Equipment:
   In all solicitations, either by competitive bidding or negotiation made by the Contractor for work to be performed under a subcontract, including procurement of materials or leases of equipment, each potential subcontractor or supplier shall be notified by the Contractor, of the Contractor's obligations of this contract and Regulations relative to nondiscrimination on the grounds of race, color, religion, sex, or national origin.

4. Information and Reports:
The Contractor shall provide all information and reports required by Regulations and/or Directives issued pursuant thereto and shall permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the state of Idaho Transportation Department or the Federal Highway Administration to be pertinent to ascertain compliance with such Regulations or directives. Where any information required of a Contractor is in the exclusive possession of another who fails or refuses to furnish this information, the Contractor shall so certify to the state of Idaho Transportation Department or the Federal Highway Administration as appropriate, and shall set forth what efforts it has made to obtain the information.

5. Sanctions for Noncompliance:
In the event the Contractor is in noncompliance with the nondiscrimination provision of this contract, the state of Idaho Transportation Department shall impose such contract sanctions as it or the Federal Highway Administration may determine to be appropriate, including, but not limited to:

a. Withhold progress payments until it is determined that the contractor is found in compliance;

b. Suspend the contract, in whole or in part, until the contractor or subcontractor is found to be in compliance with no progress payment being made during this time and no time extension made;

c. Cancel or terminate the contract for cause;

d. Assess against the contractor's final payment on this contract or any progress payments on current or future Idaho projects an administrative remedy by reducing the final payment or future progress payment in an amount equal to 10% of this contract or $7,700, whichever is less.

6. Incorporation of the Provisions:
The Contractor shall include the provisions of paragraphs (1) through (6) in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Regulations, or directives issued pursuant thereto. The Contractor shall take such action with respect to subcontractor or procurement as the state of Idaho Transportation Department or Federal Highway Administration may direct as a means of enforcing the provisions, including sanctions for noncompliance, provided, however, that in the event a Contractor becomes involved in, or is threatened with litigation with a subcontractor or supplier as a result of such direction, the Contractor may request the state of Idaho Transportation Department to enter into such litigation to protect the interests of the State, and in addition, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

III. LABOR PROVISIONS

The wages of labor shall be paid in legal tender of the United States, except that this condition will be considered satisfied if payment is made by a negotiable check, on a solvent bank, which may be cashed readily by the employee in the local community for the full amount without discount or collection charges of any kind. Where checks are used for payment, the contractor shall make all necessary arrangements for them to be cashed and shall give information regarding such arrangements. No fee of any kind shall be asked or accepted by the contractor or any of his agents from any person as a condition of employment on the project.

No employee shall be charged for any tools used in performing their respective duties except for reasonably avoidable loss or damage thereto.

Every employee on the work covered by this contract shall be permitted to lodge, board and trade where and with whom he elects and neither the contractor nor his agents nor his employees shall directly or indirectly require as a condition of employment that an employee shall lodge, board or trade at a particular place or with a particular person.

No charge shall be made for any transportation furnished by the contractor or his agents to any person employed on the work.

No individual shall be employed as a laborer on this contract except on a wage basis, but this shall not be construed to prohibit the rental of teams trucks or other equipment from individuals. No such rental agreement or any charges for feed, gasoline, supplies or repairs on account of such agreement, shall cause any deduction from the wages accruing to any employee except as authorized by the regulations hereinbefore cited.

CONTRACTOR'S AFFIDAVIT
CONCERNING ALCOHOL AND DRUG-FREE WORKPLACE

STATE OF _____

COUNTY OF _____

Pursuant to the Idaho Code, Section 72-1717, I, the undersigned, being duly sworn, depose and certify that _____ is in compliance with the provisions of Idaho Code section 72-1717; that _____ provides a drug-free workplace program that complies with the provisions of Idaho Code, title 72, chapter 17 and will maintain such program throughout the life of a state construction contract and that _____ shall subcontract work only to subcontractors meeting the requirements of Idaho Code, section 72-1717(1)(a).

_____
Name of Contractor

_____
Address

_____
City and State

By: _____
(Signature)

Subscribed and sworn to before me this _____ day of _____, _____.

Commission expires:

_____
NOTARY PUBLIC, residing at

_____

_____